RESTRICTED

PILOTS' *Information* FILE

NOTICE: This document contains information affecting the National Defense of the United States within the meaning of the Espionage Act, 50 U.S.C., 31 and 32, as amended. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

RESTRICTED

RICHARD P. JERRARD

THIS BOOK CONTAINS THE REVISIONS LISTED BELOW

REVISION NO.	DATE	REVISION NO.	DATE
1	MAY 20, 1943		
2	AUG. 1, 1943		
3	OCT. 1, 1943		
4	DEC. 1, 1943		
5	JAN. 1, 1944		
6	FEB. 1, 1944		
7	MARCH 1, 1944		
8	APRIL 1, 1944		
9	MAY 1, 1944		
10	JUNE 1, 1944		
11	JULY 1, 1944		
12	AUGUST 1, 1944		
13	September 1, 1944		
14	November 1, 1944		
15	January 1, 1945		
16	Febuary 1, 1945		

AS YOU PLACE REVISIONS IN THIS BOOK,
WRITE REVISION NUMBERS AND DATE IN SPACE ABOVE

AAF REGULATION)
NO. 62-15)
EXTRACT)

HEADQUARTERS, ARMY AIR FORCES
WASHINGTON, 24 NOVEMBER 1944

FLYING SAFETY

Information Files

(This Regulation supersedes AAF Regulation 62-15, 28 February 1944 and 62-15A, 1 May 1944.)

1. **General.** To promote safe flying and operational efficiency, AAF pilots, navigators, bombardiers, flight engineers, flight surgeons, aviation medical examiners and airborne radio operators who are on flying status must be familiar with many items of a general nature, with the results of current research, and with other instructions and information found in a variety of War Department, AAF, and other pertinent publications which are not always readily available to them. These items will be selected, organized, and presented in simple, non-technical form in loose-leaf books, to be designated as follows:

a. For pilots, flight surgeons, aviation medical examiners who are on flying status, and flight engineers: The "Pilots' Information File" (PIF).

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2. **Publication of PIF, NIF, and BIF.** The Office of Flying Safety will be responsible for the selection of items, the coordination of the material, the form and treatment of the subject material, the proper illustration of the text, and the publication of the Files. That office will be responsible for the publication of necessary revisions. It is authorized to deal directly with all AAF organizations and establishments in gathering and coordinating instructions and information for the Files. All AAF establishments will submit items which they desire to have included in the Files directly to Office of Flying Safety, Information Files Branch, Buhl Building, Detroit 26, Michigan.

3. * * * * * *

4. **Table of Contents.** A table of contents, listing, numbering, and dating all current subjects, will be published for each File. Each table of contents will be revised every three months. The use of the tables of contents is outlined in AAF Reg. 15-24.

5. **Distribution in Continental United States.** These Information Files and revisions thereto will be distributed by the Chief, Office of Flying Safety on the following basis:

a. PIF: Through Base Operations Officers, one copy to each pilot, each flight surgeon, each aviation medical examiner who is on flying status, and each flight engineer in the domestic area. One copy to each aviation cadet. Two copies to each base operations office, group, and squadron. Copies as required to the regularly established files of AAF organizations and establishments. Copies to AAF schools and training establishments as necessary for the training program, and such copies as the Chief, Safety Education Division shall determine as necessary for the accomplishment of his basic directive.

* * * * * *

6. **Distribution in Overseas Theaters.** If commanding officers in overseas theaters and "alerted" areas so direct, PIF, NIF, BIF, ROIF, and revisions thereto will be procured by requisition to the Director, Air Technical Service Command, Wright Field, Dayton, Ohio, through Air Service Command distribution centers located in the theaters concerned.

7. **Compliance.** Commanding officers will be responsible that personnel specified in paragraph 5 certify that they have read and understand all instructions and information contained in their respective Files; and that they place the revision sheets issued to them in their personal copies of the Files so that their Files are currently correct. Compliance with this directive will be recorded as follows:

a. For pilots, flight surgeons, aviation medical examiners on flying status, and flight engineers: Form 24 (the PIF table of contents) will be signed and used as a permanent record of compliance. When PIF and revisions thereto are distributed, they will be accompanied by compliance forms (AAF Form 24A), which will provide temporary records of compliance. The use of AAF Forms 24 and 24A is set forth in AAF Reg. 15-24.

* * * * * *

e. For all other personnel authorized to receive PIF, NIF, BIF or ROIF as set forth in paragraph 5 and for whom no Form 5 files are maintained, the record of compliance will be as directed by commanding officers.

8. **Retention of Permanent Forms.** Commanding officers will be responsible that permanent forms referred to in paragraph 7 are retained for record as directed in AAF Reg. 15-24.

9. **Familiarity with Instructions Regarding Equipment.** In addition to the provisions of this Regulation, commanding officers are responsible for insuring that pilots are thoroughly familiar with all instructions and information pertaining to equipment to be flown, as provided in AAF Reg. 50-16.

10. **Activities Exempt from These Provisions.** AAF activities operating in overseas theaters and AAF activities operating in domestic areas under "alert" orders will be exempt from the provisions outlined herein to the extent determined by the commanding officer concerned.

11. **Definitions.**

a. The term "pilot" will be construed to mean any individual who holds a currently effective military aeronautical rating of Command Pilot, Senior Pilot, Pilot, Service Pilot, Liaison Pilot, or Glider Pilot.

* * * * * *

d. The term "flight engineer" will be construed to mean any individual who holds a currently effective military aeronautical rating of aircraft observer (Flight Engineer).

e. The term "flight surgeon" will be construed to mean any Medical Corps officer who is currently designated as a flight surgeon by the Commanding General, AAF.

f. The term "aviation medical examiner" will be construed to mean any Medical Corps officer who is currently designated as an aviation medical examiner by the Commanding General, AAF.

* * * * * *

By command of General ARNOLD:

OFFICIAL SEAL

HQ AAF

BARNEY M. GILES

Lieutenant General, United States Army
Deputy Commander, Army Air Forces and
Chief of Air Staff

AAF REGULATION)
NO. 15-24)
EXTRACT)

HEADQUARTERS, ARMY AIR FORCES
WASHINGTON, 23 NOVEMBER 1944

BLANK FORMS

AAF Form 24 —PIF Table of Contents
AAF Form 24A —Temporary Compliance Certificate for PIF
AAF Form 24N —NIF Table of Contents
AAF Form 24NA—Temporary Compliance Certificate for NIF
AAF Form 24B —BIF Table of Contents
AAF Form 24BA—Temporary Compliance Certificate for BIF
AAF Form 24R —ROIF Table of Contents
AAF Form 24RA —Temporary Compliance Certificate for ROIF

(This Regulation supersedes AAF Reg. 15-24, 28 Feb. 1944 and AAF Reg. 15-24A, 2 Aug. 1944.)

TABLES OF CONTENTS OF INFORMATION FILES

1. AAF Form 24 is the table of contents for the Pilots' Information File.

* * * * * *

Each has two uses:

a. As a part of the Information File for which it is the table of contents for a three-month period (until it is replaced by a revised current table of contents). Each will list, date, and number all current subjects in its pertinent Information File. An asterisk (*) prefixing any subject will indicate that the subject has been revised or added since the previous table of contents was issued.

b. As a compliance certificate for its pertinent Information File: Personnel specified in AAF Reg. 62-15 as being required to comply with pertinent information files and for whom a Form 5 file is maintained will sign the Form 24, 24N, 24B, or 24R (whichever applies). When a new table of contents is issued, it will replace the one in the Information File, and the replaced Form (24, 24N, 24B or 24R), properly signed, will be placed in the Form 5 file of the individual concerned, where it will remain as a record of compliance until the next issued Form (24, 24N, 24B or 24R) replaces it. Compliance records for personnel authorized to receive pertinent Information Files and for whom Form 5 files are not maintained will be kept as directed by Commanding Officers.

2. **Publication.** Under the authority contained in AAF Reg. 62-15, the Chief, Flying Safety will revise and publish AAF Form 24, 24N, 24B and 24R every three months. In order to facilitate identification of the date of issue, there will be a color band along one border of the respective Forms as follows:

Form 24 Issue of 1 August (any year)—Blue
Issue of 1 November (any year)—Yellow
Issue of 1 February (any year)—Red
Issue of 1 May (any year)—Gray

* * * * * *

3. **Distribution.** AAF Form 24, 24N, 24B or 24R will be distributed by the Chief, Office of Flying Safety through Base Operations Officers:

a. As a part of every complete volume of the Information File for which it is the table of contents.

b. As one sheet of revisions to the Information File to which it belongs, issued as follows:

Form 24: PIF Revisions dated 1 August, 1 November, 1 February, and 1 May.

* * * * * *

c. Upon letter request to: Office of Flying Safety, Information Files Branch,
Buhl Building, Detroit 26, Michigan.

TEMPORARY CERTIFICATES OF COMPLIANCE

4. Since Forms 24, 24N, 24B, and 24R are retained in their respective Information Files for the three-month period for which they are the current tables of contents, it is necessary to use temporary certificates of compliance for revisions which may be issued in the interim. Such temporary certificates will be issued as follows:

Form 24A for Pilots' Information File

* * * * * *

Each such temporary certificate of compliance form consists of two sections; a small detachable bottom section, the use of which is described in sub-paragraph a, below and a main upper section, the use of which is described in sub-paragraph b, below:

a. The detachable section at the bottom of each form is provided as a receipt for revision sheets (or for the complete volume of the pertinent Information File issued to any individual entitled to it). The individual receiving any Information File material will indicate by signature thereon that he has received it. Operations Officers will hold such receipts for their records until the compliance (main upper section of Form 24A, 24NA, 24BA or 24RA) is received. Whenever Information File material is issued to any individual entitled to it at any station other than his home base, his receipt (the lower detachable section) will be forwarded by the issuing agency to the base operations office of the recipient's home station.

b. The main (upper) section of Forms 24A, 24NA, 24BA and 24RA will list in red the revision number and the page numbers for which each is to serve as a temporary compliance certificate. When issued with the complete volume of the Information File, it will indicate that it applies to the complete volume of the pertinent Information File and indicate (in red) the revision numbers contained as an integral part of that edition of the Information File. An individual concerned will sign this portion of the Form to certify that:

(1) He has read and understands the Information File material listed therein.

(2) He has **removed** from the Information File and **destroyed** all sheets that specific instructions printed on the envelope which contains the Information File material direct him to remove and destroy.

(3) He has placed each revision sheet listed in the compliance certificate in its proper place in the Information File.
When the individual concerned has complied with (1), (2), and (3) above, **(and not before)**, he will sign the compliance certificate (the upper section of Form 24A, 24NA, 24BA or 24RA) and return it to the base operations officer at his home station.

5. Operations Officers will be responsible that the properly executed compliance certificate (upper section of Forms 24A, 24NA, 24BA, or 24RA) is returned within a reasonable time (but in no case longer than 30 days after receipt) and, in the case of personnel for whom Form 5 files are maintained, placed in the Form 5 file of the individual concerned. It will remain there until the individual has executed the next dated table of contents (Form 24, 24N, 24B, or 24R, whichever applies) and turned it in, when all previously dated compliance certificates (Forms 24A, 24NA, 24BA or 24RA) and the previous table of contents will be removed and destroyed. Compliance certificates for personnel for whom Form 5 files are not maintained will be retained for record as directed by commanding officers.

6. **Distribution.** AAF Forms 24A, 24NA, 24BA and 24RA will be published by the Chief, Office of Flying Safety and distributed:

a. Through Operations Officers, automatically inclosed with each set of revisions and each complete volume of any Information File.

b. Upon letter request from Operations Officers to:

Office of Flying Safety, Information Files Branch
Buhl Building, Detroit 26, Michigan

7. **Destruction of Unused Forms.**

a. Unused Forms 24, 24N, 24B and 24R become obsolete and will be destroyed six months after the date of issue.

b. Forms 24A, 24NA, 24BA and 24RA held in excess of the material to which they apply will be destroyed.

By command of General ARNOLD:

OFFICIAL SEAL
HQ AAF

BARNEY M. GILES
Lieutenant General, United States Army
Deputy Commander, Army Air Forces and
Chief of Air Staff

WAR DEPARTMENT
AAF FORM No. 24
APPROVED 4-1-43

TABLE OF CONTENTS *Pilots' Information File*

When you place this form No. 24 in your PIF, remove the Table of Contents now in your PIF (red border), sign it, and give it to your Base Operations Officer.

In accordance with the provisions of AAF Regulation 62-15, all AAF pilots, designated flight surgeons, designated aviation medical examiners, and flight engineers in the United States will certify that they have read and understand all instructions and information contained in Pilot's Information File. They will do so by signing in the space provided at the end of the Table of Contents. Remove the old Table of Contents for February, March, April, 1945 now. Sign it and give it to your Operations Officer for placement in your Form 5 file.

Subjects preceded by an asterisk (*) have been revised or added to PIF since Feb. 1, 1945. Be sure your copy of PIF contains all amendments. Read them carefully before signifying compliance on Form 24A.

Check with operations offices regularly to be sure you have all current amendments to PIF and Table of Contents. The Table will be revised quarterly and distributed on the same basis as the Pilots' Information File.

Blank spaces at the end of sections are for your convenience. Enter new subjects in their proper place as you receive them.

AUTHORITY FOR PIF—AAF REGS. 62-15; 15-24

TABLE OF CONTENTS—AAF FORM 24:

SECTION ONE—GENERAL

Subject and Date	PIF No.
Pilot's Responsibilities (Nov. 1, 44)	1- 1
Flying Safety (July 1, 44)	1- 2
Safeguarding Classified Material (May 1, 44)	1- 3
How to Use PIF (Jan. 1, 45)	1- 4
Technical Orders (May 1, 43)	1- 5
Unsatisfactory Reports (Oct. 1, 43)	1- 6
Flying on a Red Diagonal (May 1, 44)	1- 7
Transition Flying Training (May 1, 43)	1- 8
Instrument Flying (May 1, 44)	1- 9
*Time Credit (May 1, 45)	1-10
Aeronautical Ratings (Jan. 1, 45)	1-11
Reporting Aircraft Accidents (Aug. 1, 44)	1-12
Forms (Aug. 1, 44)	1-13

SECTION TWO—FLIGHT

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AAF Flight Control (Jan. 1, 45)	2- 0
Air Traffic Rules (July 1, 44)	2- 1
Clearance for Aircraft (July 1, 44)	2- 2
Radio Change in Flight Plan (July 1, 44)	2- 3
Passengers in Aircraft (July 1, 44)	2- 4
Air Space Reservation and Flight Hazards (Feb. 1, 44)	2- 5
Low Flying (April 1, 44)	2- 6
Crew Requirements for Multi-engined Airplanes (May 1, 43)	2- 7
Taxiing—Ground Crew Signals (Oct. 1, 43)	2- 8
Takeoff, Landing Precautions (Sept. 1, 44)	2- 9
Check Lists (Nov. 1, 44)	2-10
Marking Obstructions (June 1, 44)	2-11
Runway Markings (June 1, 44)	2-12
Camouflage (Oct. 1, 43)	2-13
Radio Equipment (Sept. 1, 44)	2-14
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Visual Signals for Formations (May 1, 43)	2-17
Tower Light Gun Signals (May 1, 44)	2-18
Flight Limitations (Sept. 1, 44)	2-19
Spins and Stalls (Jan. 1, 45)	2-20
High Speed Dives (Sept. 1, 44)	2-21
*Engine Failure on Multi-engined Aircraft (May 1, 45)	2-22

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*Weather Planning (May 1, 45)	3- 1
*Weather Maps (May 1, 45)	3- 2
*Forecasts and Sequences (May 1, 45)	3- 3
*Weather Aloft (May 1, 45)	3- 4
*Clearance Weather (May 1, 45)	3- 5
*Weather in Flight (May 1, 45)	3- 6
*Rules for Flying Weather (May 1, 45)	3- 7
*Flight Instruments (April 1, 45)	3- 8

WAR DEPARTMENT
AAF FORM No. 24
APPROVED 4-1-43

SECTION FOUR—MAN GOES ALOFT

Subject and Date	PIF No.	Subject and Date	PIF No.
Effects of High Altitude (Feb. 1, 45)	4- 1	Climate and Health (Feb. 1, 45)	4- 7
Oxygen Equipment (Feb. 1, 45)	4- 2	*G Forces (April 1, 45)	4- 8
Oxygen Emergencies (Feb. 1, 45)	4- 3	Sense of Position in Flight (Aug. 1, 44)	4- 9
Dangerous Gases (Feb. 1, 45)	4- 4	*The Flight Surgeon (April 1, 45)	4-10
Physical Fitness (Feb. 1, 45)	4- 5		
Night Vision (Feb. 1, 45)	4- 6		

SECTION FIVE—POWER PLANT

*Power Evaluation (April 1, 45)	5- 1	*Feathering (April 1, 45)	5- 7
*Operating Efficiency (April 1, 45)	5- 2	*Jet Propulsion (April 1, 45)	5- 8
*Fuel (April 1, 45)	5- 3	*Water Injection (April 1, 45)	5- 9
*Superchargers (April 1, 45)	5- 4	*Cruise Control (April 1, 45)	5-10
*Engine Instruments (April 1, 45)	5- 5		
*Electrical System (April 1, 45)	5- 6		

SECTION SIX—THE AIRPLANE

*Tricycle Landing Gear (May 1, 45)	6- 1	*Emergency Exits (May 1, 45)	6- 7
*Landing Wheel Brakes (May 1, 45)	6- 2	Safety Belts (April 1, 44)	6- 8
*Flaps (May 1, 45)	6- 3	Safety Precautions (Nov. 1, 44)	6- 9
*Trim (May 1, 45)	6- 4	Weight and Balance (Nov. 1, 44)	6-10
*Surface Control Locks (May 1, 45)	6- 5		
*Care of the Airplane (May 1, 45)	6- 6		

SECTION SEVEN—NAVIGATION AIDS

Flight Preparations (Nov. 1, 44)	7- 1	Night Navigation (Nov. 1, 44)	7- 6
Aeronautical Charts (Nov. 1, 44)	7- 2	What to Do When Lost (Nov. 1, 44)	7- 7
Dead Reckoning (Nov. 1, 44)	7- 3		
Wind (Nov. 1, 44)	7- 4		
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SECTION EIGHT—EMERGENCY

To Bail or Not to Bail (Jan. 1, 45)	8- 1	Life Preserver Vest (Nov. 1, 44)	8-10
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Parachutes (Jan. 1, 45)	8- 4	First Aid Kits (Feb. 1, 45)	8-13
Pyrotechnic Pistols (May 1, 43)	8- 5	First Aid in Flight (April 1, 44)	8-14
Smoke Grenades (May 1, 43)	8- 6		
Panel Signals (May 1, 43)	8- 7		
Body Signals (May 1, 43)	8- 8		
Emergency Kits (Jan. 1, 45)	8- 9		

I certify that I have read and understand all subjects in the Pilots' Information File listed in Form 24, dated May 1945.

When you receive your new Form 24, dated August 1945, remove this form, sign it, and give it to your Operations Officer to put in your Form 5 file.

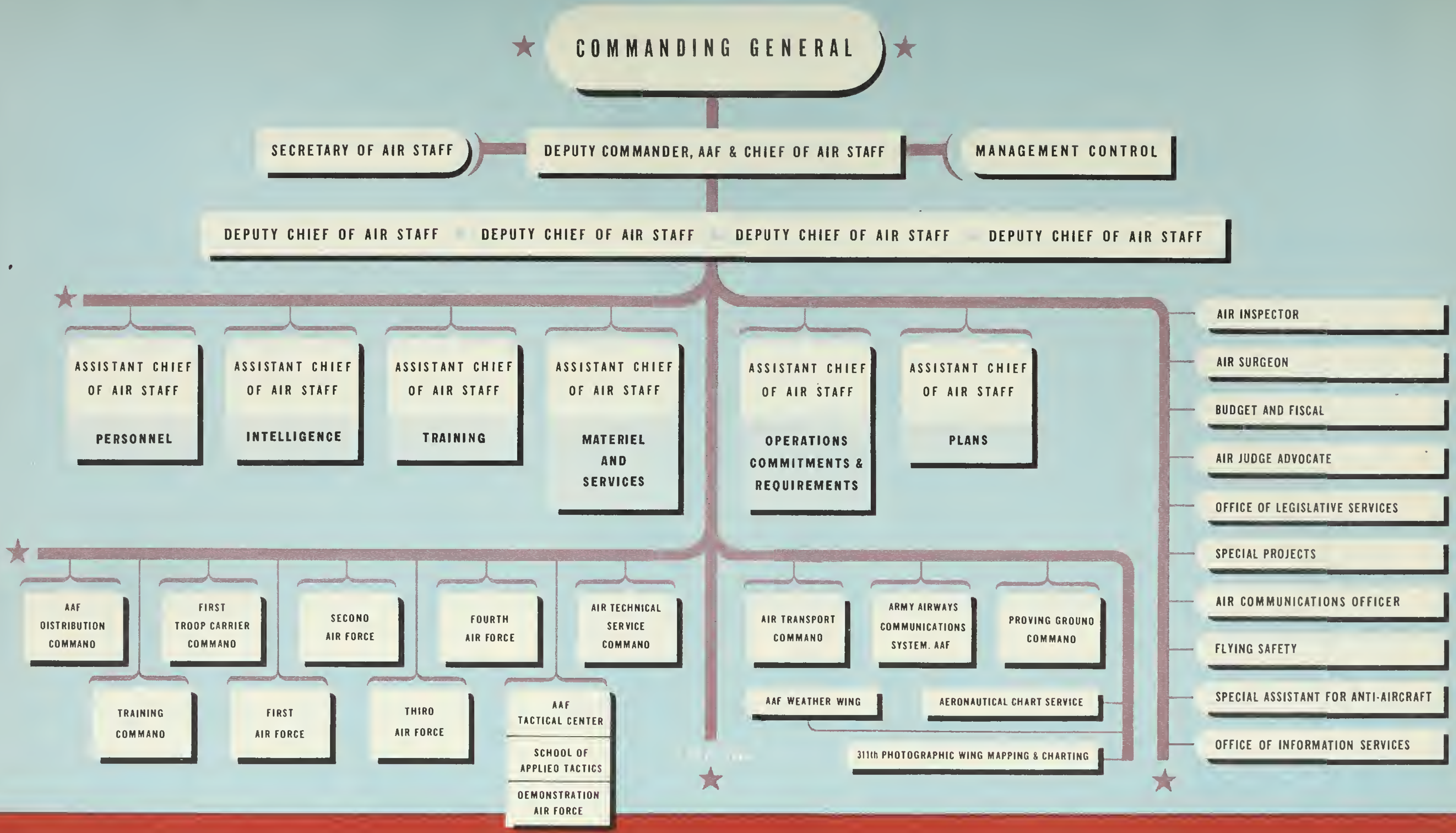
SIGNED____________________

RANK__________ ASN__________

ORGANIZATION__________ CREW NO.__________

DATE____________________

Directory Chart Headquarters Army Air Forces



- COMMANDING GENERAL
  - DEPUTY COMMANDER, AAF & CHIEF OF AIR STAFF
    - SECRETARY OF AIR STAFF
    - MANAGEMENT CONTROL
    - DEPUTY CHIEF OF AIR STAFF — DEPUTY CHIEF OF AIR STAFF — DEPUTY CHIEF OF AIR STAFF — DEPUTY CHIEF OF AIR STAFF
      - ASSISTANT CHIEF OF AIR STAFF PERSONNEL
      - ASSISTANT CHIEF OF AIR STAFF INTELLIGENCE
      - ASSISTANT CHIEF OF AIR STAFF TRAINING
      - ASSISTANT CHIEF OF AIR STAFF MATERIEL AND SERVICES
      - ASSISTANT CHIEF OF AIR STAFF OPERATIONS COMMITMENTS & REQUIREMENTS
      - ASSISTANT CHIEF OF AIR STAFF PLANS
      - AIR INSPECTOR
      - AIR SURGEON
      - BUDGET AND FISCAL
      - AIR JUDGE ADVOCATE
      - OFFICE OF LEGISLATIVE SERVICES
      - SPECIAL PROJECTS
      - AIR COMMUNICATIONS OFFICER
      - FLYING SAFETY
      - SPECIAL ASSISTANT FOR ANTI-AIRCRAFT
      - OFFICE OF INFORMATION SERVICES
      - AAF DISTRIBUTION COMMAND
      - TRAINING COMMAND
      - FIRST TROOP CARRIER COMMAND
      - FIRST AIR FORCE
      - SECOND AIR FORCE
      - THIRD AIR FORCE
      - FOURTH AIR FORCE
      - AAF TACTICAL CENTER
        - SCHOOL OF APPLIED TACTICS
        - DEMONSTRATION AIR FORCE
      - AIR TECHNICAL SERVICE COMMAND
      - AIR TRANSPORT COMMAND
      - AAF WEATHER WING
      - ARMY AIRWAYS COMMUNICATIONS SYSTEM, AAF
      - PROVING GROUND COMMAND
      - AERONAUTICAL CHART SERVICE
      - 311th PHOTOGRAPHIC WING MAPPING & CHARTING

SECTION 1 GENERAL

PILOT'S RESPONSIBILITIES

★The success of any flying mission, whether in training or combat operations, depends primarily upon the pilot. As commander of the airplane you carry heavy responsibilities. The majority of your responsibilities, however, involve only good, sound judgment.

★All of your duties make up a long and formidable list; but you can discharge each of them by systematic planning, step by step. Don't overlook anything. Establish a routine. Memorize and follow a check list of your responsibilities.

Before Flight

PLAN

FORM 23

★Plan your flight on Form 23.

★Remember that the shortest distance between two points is not always a straight line.

★Check terrain features on your line of flight: maximum altitude of mountains, facilities for emergency landings.

★Airways, radio facilities, check points.

WEATHER

★Talk to the forecaster, don't be satisfied with the brief forecast on your Form 23.

★Know the over-all weather picture. Study the latest weather map.

★Read the weather sequences yourself.

★Check winds aloft, and plan your flight to take advantage of the best altitude.

★Know temperatures, dewpoints, and barometric readings along your line of flight.

★Altimeter setting at point of departure and destination.

CHARTS

★Secure the latest sectional and regional maps.

★Check them against the chart in the operations office for changes.

★Look up the latest information in NOTAMS on danger and caution areas.

★Draw a pencil line along your intended route, and mark it off in 20-mile intervals.

★Don't start any flight without proper charts!

EQUIPMENT

AIRPLANE

★ Check and know the condition of your plane.
★ Visual check.
★ Freedom of movement of all controls.
★ Check Form 1A and Form 41B.

FUEL

★ Servicing crews fuel the airplane but the pilot is solely responsible for his fuel supply.
★ Check fuel tanks visually; don't rely solely on fuel gages.
★ If flying a long mission, be sure to study cruise control charts for best power setting at your predetermined altitude.

WEIGHT AND BALANCE

★ Check the loading of your airplane.
★ Be sure the Form F is properly executed and the final index is within the allowable center of gravity range.
★ Read and understand the provisions of AAF Reg. 55-3.
★ The Weights and Balance officer is charged with the responsibilities of compliance with the regulations; but remember you have to fly the airplane.

RADIO

★ Test the frequencies you will use.
★ Be sure your modulation is correct.
★ Tune in your nearest radio range.
★ Check command, liaison, interphone, and call.
★ See that your radio compass is working.

FLIGHT RESTRICTIONS

★ Check and know all flight restrictions and special orders concerned with the type of airplane in which the flight is to be made.

EMERGENCY EQUIPMENT

★ Check the equipment necessary for the flight:
★ Oxygen.
★ Life rafts.
★ Mae Wests.
★ Parachutes.
★ Emergency kits.
★ First-aid kits.

CREW

INSPECT CREW'S CLOTHING AND EQUIPMENT

★ Proper clothing for altitude, temperature, and season.
★ Oxygen masks, properly fitted and in good condition.
★ Parachutes—harness properly fitted. Each crew member instructed in how to inspect and use his parachute.

DUTIES IN FLIGHT

★ See that each crew member knows his place in the airplane, and his duties in flight.
★ Assure yourself that each crew member understands emergency procedures; that he knows what exit to use in bailout; and is trained in ditching procedure, and forced landing routine.
★ You are responsible that the crew has been properly briefed for the flight.
★ See that each has made the proper preflight inspection of everything he is responsible for.

Pilot's Basic Responsibility

On every mission it is up to you to get there and back! So plan, inspect, and check thoroughly. Be absolutely sure of every pertinent item listed above to make certain of a successful flight.

During Flight

COMMAND OF THE AIRPLANE

★ During flight you will ordinarily be in command of your airplane, the crew, and any passengers aboard. Army Regulation 95-15 directs that, "The senior member of the operating crew of an aircraft who holds an appropriate military pilot rating will command the aircraft, except when the organization commander responsible for the aircraft specifically designates who shall command."

CHECK LISTS

★ Use check lists in cockpit for takeoff, cruise, and landing procedure.

★ Use cruise control charts for airplanes in which they are provided.

FOLLOW YOUR FLIGHT PLAN

★ Adhere strictly to your flight plan as outlined on Form 23, except in an emergency.

★ If it's necessary to change your flight plan, get the necessary approval by radio.

CHECK POINTS

★ Report your position frequently over radio check points, giving:

★ Point of takeoff.

★ First intended landing.

★ ETA (Estimated Time of Arrival).

★ Altitude.

★ Time of report.

★ Any unusual weather encountered.

NAVIGATION

★ Consult your charts regularly; know your position all the time.

★ Don't navigate solely by radio aids. Check and double check your position frequently.

★ Check your wind drift; don't take it for granted that the winds aloft information you get at the weather office is correct, or that the wind hasn't changed.

★ Check time, speed, and distance, frequently.

★ If flying airways on CFR, maintain the correct odd or even altitude depending on your direction of flight.

LISTENING WATCH

★Keep your radio tuned to the range and maintain an alert listening watch for "Army Flight Control advises - -". They may be trying to call you.

WEATHER

★Check weather reports along your line of flight.

★Ask by radio for weather reports whenever in doubt.

★Watch for any change in sky or cloud conditions that may indicate weather change.

FUEL CONSUMPTION

★Make periodic checks of your fuel supply.

★Check all your fuel gages.

★Check indicated consumption against speed, time, and distance.

★Calculate indicated fuel remaining and distance to go.

★Know most economical power setting.

★Make certain you have fuel reserve.

After Landing

★Complete Forms 1 and 1A before you leave the cockpit.

★Hand the yellow copy of Form 23 to the line chief to turn in at the operations office. It is your responsibility to see that the arrival record is properly filled in.

REQUEST SERVICE REQUIRED

★Fuel, oil, repairs.

★If fuel and oil must be secured from a commercial contractor, you must sign Form 81. Keep a copy to file at your home station.

★If you have secret or confidential equipment aboard your plane, see that it is properly guarded or removed to a safe.

★Report to the weather office to execute Form 37 (Weather Interview).

IF OTHER THAN HOME BASE, REPORT:

★Where you will stay.

★Proposed time of departure.

★Proposed next destination.

★Make sure your crew is properly cared for.

★Send, or arrange for operations to send, RON message to your home station. This is the proper form; it may be sent government telegram, collect, TWX, or AACS.

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Commanding Officer
Attention Operations Officer
Randolph Field, Texas
  Army 43-7436 R.O.N. Pampa AAB
  Pampa, Texas, 13 April 1944
                          DORAN
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FLYING SAFETY

PILOT ERROR IS THE CAUSE OF
70 TO 80 PERCENT OF ALL AIRCRAFT ACCIDENTS

PILOT ERROR RESULTS FROM —

- ★ Ignorance
- ★ Carelessness
- ★ Poor physical condition
- ★ Disobedience
- ★ Poor judgment

In the campaign to defeat these enemies of safety, authorities have prescribed rules, regulations, and standard practices; but they can only point the way—

SAFETY OF FLIGHT DEPENDS UPON YOU

- ★ Know the rules
- ★ Abide by the rules
- ★ Keep constantly on the alert
- ★ Use considered judgment
- ★ Keep yourself physically fit
- ★ Plan in advance for possible emergencies and work out in your own mind procedures you propose to follow for each

The most important rule of safety is:

KNOW THE AIRPLANE YOU ARE ABOUT TO PILOT

General check-out procedure requires a pilot to demonstrate his proficiency on any type of aircraft before being cleared to fly it.

Check-out procedures are prescribed locally by Commanding Officers, setting forth minimum time in cockpit familiarization, taxiing, and minimum number of landings. Careful study of the Handbook of Flight Operating Instructions of the particular model of the airplane to be flown is required.

Do not be satisfied with minimum requirements for check-out. No pilot was ever too familiar with his plane.

If you are not certain that you know and understand the airplane you are about to fly, **it is your right and duty to request further instruction and more time.**

Do not be satisfied merely with check-out. After you have been certified as qualified for a type of aircraft, **watch constantly for new information, flight restrictions, and special instructions issued from time to time.** All these will be found in the Transition Flying Training Index.

Finally, you must always check the particular airplane you are about to fly and **make certain that you are familiar with all modifications, special equipment, and the present condition of the airplane.**

* * *

KNOW AIR TRAFFIC RULES AND REGULATIONS

There are uniform traffic rules for flying the airways.

Know the rules.

Plan your flight in accordance to the rules.

Adhere strictly to your flight plan (except as provided for in the rules).

Keep on the lookout for other traffic.

On local flights, be sure you know the local regulations and restrictions. When in doubt, use common sense and courtesy.

If possible, ask for traffic information.

Conform to local traffic pattern.

Keep constantly alert.

Keep away from other aircraft in flight.

Don't be an Air Hog!

* * *

KNOW WHAT THE WEATHER IS ON YOUR PROPOSED LINE OF FLIGHT

In almost every case where weather is the cause of an aircraft accident, it is chargeable to **Pilot Error**: because the pilot didn't know what kind of weather he was going to encounter.

Do not take a chance on doubtful weather.

Beware of icing conditions.

Remember that your carburetor may ice under almost any temperature conditions, summer or winter. All it needs is moisture.

If you run into bad weather conditions **go around, not through**, or turn back.

The safest maneuver in doubtful weather is the 180-degree turn!

* * *

KNOW YOUR INSTRUMENTS

Instrument Failure seldom causes aircraft accidents. When it is a contributing cause, it is usually the pilot's fault for not using them correctly.

Know how to check your instruments.

Know instrument procedures.

Trust your instruments.

The most important safety rule in instrument flying is: **have confidence in your instruments, in yourself, and in your ability to fly instruments.**

Such confidence can only be developed by practice; take advantage of every opportunity to use the Link Trainer, to make hooded flights, and to fly on instruments under proper supervision.

Do not be satisfied with the minimum requirements for an instrument rating.

* * *

KNOW HOW TO USE YOUR OXYGEN EQUIPMENT

Accidents that are chargeable to lack of oxygen are usually due to **Pilot Error**. There is always more than one source of oxygen. If you know your equipment, you can avoid trouble.

Be sure your oxygen mask fits properly. Adjust it before take-off.

Know how to switch from one source of oxygen to another.

Begin the use of oxygen soon enough.

Remember that even a short period of oxygen starvation ruins your judgment.

KEEP CONSTANTLY ALERT IN TAXIING

More than half of all aircraft accidents occur on the ground. Practically all taxiing accidents are 100% carelessness.

Keep your eyes open. Look ahead of you, look behind you, look above you.

If you are taxiing a "blind" airplane, zigzag enough to know what is in front of you.

Keep your radio tuned to the tower, listen for warnings.

Do not taxi within 100 feet of the line without a crew man in full view in front of you, guiding you by hand signals.

Taxi slowly.

Be sure you know how to operate the emergency brake system on your plane.

USE EXTRA PRECAUTION ON TAKE-OFF

The chief hazards on take-off arise from engine failure and poor piloting technique.

Be sure your engines are properly warmed up and functioning perfectly before beginning a take-off.

Do not take a chance on an engine that doesn't "rev up" on the ground.

If an engine fails on take-off **get the nose down** and decide instantly on your procedure:

Is there enough landing field left to stand a chance of getting down?

Can you find a spot approximately straight ahead for a forced landing?

Do **not** try to stretch your glide.

Above all do not bank. Remember your plane stalls at higher speed on a bank than in level flight.

If you must crash land, be sure to get the landing wheels up.

ON LANDINGS, PUT YOUR WHEELS ON THE FIRST THIRD OF THE LANDING STRIP

Most landing accidents are due to overshooting.

On your approach, **keep your plane enough above stalling speed to have full control.**

If you have misjudged on your approach, **there is no disgrace in going around again.**

At all Times

Do not try to show off.

Never try maneuvers with an airplane unless and until you know such maneuvers are permitted in that type of airplane.

Remember that **altitude above you will never help you get out of trouble.**

Finally

FLYING IS AN EXACTING, SERIOUS BUSINESS. IT DEMANDS EVERYTHING YOU HAVE OF KNOWLEDGE, ATTENTION, EFFORT, JUDGMENT, AND SKILL. IF YOU GIVE IT ANY LESS THAN YOUR BEST, IT EXACTS A HIGH PRICE FOR YOUR MISTAKES.

SAFEGUARDING CLASSIFIED MATERIAL

Military information is classified as secret, confidential, or restricted. Its classification is clearly marked on every page. If it is not so marked, it is unclassified. Treat all classified material as follows:

Secret

Only persons directly concerned should read it. It should be discussed only with those who may read it. It must be kept in a 3-combination safe when not in use. It must be mailed in two envelopes, an inner envelope addressed properly and marked or stamped **Secret; an outer envelope addressed properly, but with no marking to indicate its classification. Send it by registered mail.**

To destroy secret or confidential material, burn it, or use an approved shredding machine. Until you can do one or the other, tear it in small pieces, and safeguard it as you would the original material.

Confidential

May be read only by persons in the military establishment and by civilians whose duties require that they read it. It may be discussed with those authorized to read it, **but never over the telephone.** Mail and guard it the same as secret material.

Restricted

May be read by, and discussed with anyone whose loyalty is unquestioned. It is never to be released for publication, or discussed with the general public. It is to be kept in a guarded area, behind locked doors, or in a safe.

Mail by first class mail unmarked.

To destroy, tear up the material before throwing it into a waste basket.

Inspection

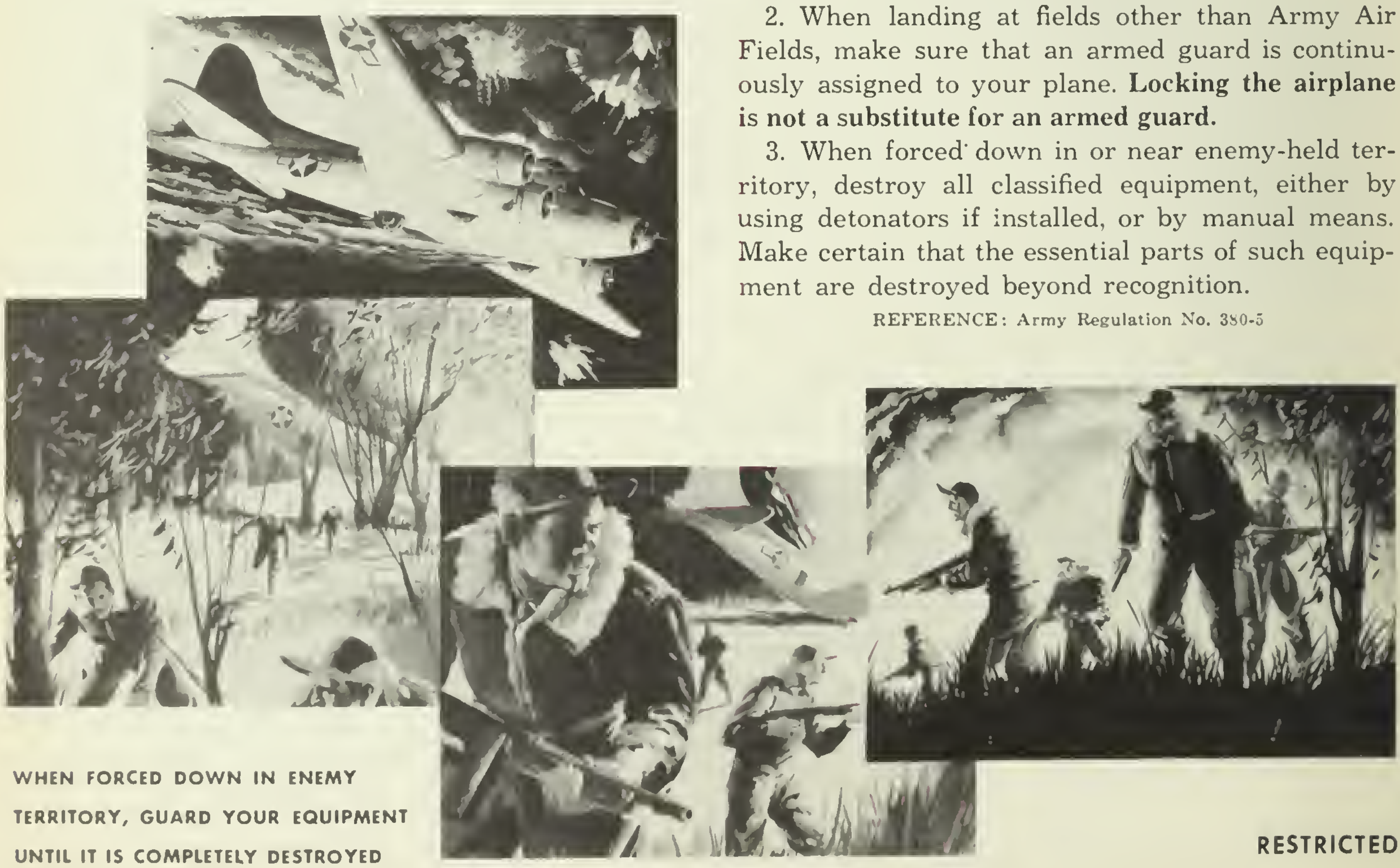
At every Headquarters an inspection will be made each day immediately before closing to insure that classified material is properly taken care of.

CLASSIFIED EQUIPMENT

As a member of an air crew you are charged with the proper care and handling of all classified equipment on your plane, such as: Certain radio equipment, some instruments, armament, etc. If any such classified equipment is installed in your plane, you must safeguard it as follows:

1. When landing at an Army Air Field, either post an armed guard or remove the equipment and place it in a locked safe or vault.
2. When landing at fields other than Army Air Fields, make sure that an armed guard is continuously assigned to your plane. **Locking the airplane is not a substitute for an armed guard.**
3. When forced down in or near enemy-held territory, destroy all classified equipment, either by using detonators if installed, or by manual means. Make certain that the essential parts of such equipment are destroyed beyond recognition.

REFERENCE: Army Regulation No. 380-5



WHEN FORCED DOWN IN ENEMY TERRITORY, GUARD YOUR EQUIPMENT UNTIL IT IS COMPLETELY DESTROYED

HOW TO USE PIF

Your PIF *Responsibility*

When you receive PIF revisions you are required by AAF Regulations 62-15 and 15-24 to do the following:

1. Sign the receipt portion of Form 24A (which is always enclosed as the first sheet of every revision). Hand this receipt at once to the operations office where you receive the revision.

2. Read the directions on the envelope which contains the revision.

3. **Remove from your PIF and destroy** the pages which are listed on the envelope. Don't try to short-cut and place the revision pages in at the same time you remove the replaced pages. You are sure to make mistakes. Do it one step at a time. Go clear through your book and take all pages out that are listed on the envelope. **This is vital.**

4. Read and study the revision sheets until you understand them.

5. Place the revision sheets in **their proper place** in your copy of PIF.

6. When you have done all of the above, **and not until you have done it all properly**, sign the compliance section of Form 24A and return it to your operations officer so that it may be placed in your Form 5 file.

You have 30 days (by AAF Regulation 15-24) in which to do all of the above. If you have neglected any of the steps above you have violated Regulations and are subject to disciplinary action.

The duties outlined here require perhaps two hours a month. If you shirk or neglect these duties your PIF cannot be useful to you. It must be currently correct or you cannot add new revisions properly.

Pilots' Information File is your book. It was designed to save you many hours of work. You would have to search and read through thousands of pages of War Department, AAF, and miscellaneous publications to get the information which you have to have to keep up-to-date with your duties and responsibilities, if it were not for PIF.

General

The Pilots' Information File is a manual of instructions and information of a general nature, with which all AAF pilots in the continental United States are required to comply, in accordance with the provisions of AAF Regulation 62-15.

PIF is designed to keep you informed of matters affecting flying safety and operational efficiency. It contains basic material not discussed in detail in Handbooks of Flight Operating Instructions and other publications comprising the Transition Flying Training Index.

Familiarize yourself with both the Pilots' Information File and the Transition Flying Training Index. Check frequently to be sure that you have read and understand the information in each.

How Subjects Are Numbered

Each subject listing is numbered. **The first number** indicates the section. For example, 2, which is Flight. **The second number** refers you to the subject. For example, 2-20, "Stalls and Spins." **The third number** lists the page. Thus, the third page of "Stalls and Spins" will be marked 2-20-3.

Revisions

Revised sheets bear a new date line in the upper right hand corner thus: REVISED February 1, 1944. If the page is new and does not replace an old one, it will bear a line thus: ADDED February 1, 1944.

Often a whole subject will be revised completely and the revised pages may number more or less than the pages they replace. In such a case all the pages will merely bear the REVISED notation, with the date. So don't be confused if you have more or fewer pages than you have removed.

To Comply with Revisions

When you receive a set of revision sheets from your operations·office, you will find in the envelope a temporary certificate of compliance (Form 24A).

Before you sign it to certify that you have read and understand all the revisions, be sure you have read and have complied with each item you are certifying to.

You will find that often only minor changes have been made on some pages. There is no special indication to show what sentences or paragraphs have been revised. It is felt that you should re-read the whole page in order to get the context of the old material in relation to the new.

Distribution of Revisions

Revisions are distributed to individual pilots by the Base Operations Officer, who receives revisions automatically from the publisher of the File.

If any Operations Officer does not receive the correct number of revisions (plus a 10% overage) he will communicate at once with:

Office of Flying Safety, Information Files Branch,
Buhl Building, Detroit 26, Michigan.

stating number of revisions required at his station. He will also send letter request to the above for any copies he may need of the complete File.

Operations Officers will also report promptly on the activation or deactivation of any station.

The Table of Contents (Form 24)

Every three months you will receive a new Table of Contents in the envelope with the revisions of that month. In order that you may identify it, and be sure that you have the current table in your PIF. the following color key is used.

February : Red   May : Gray
August : Blue   November : Yellow

Subjects preceded by an asterisk (*) have material revised or new since the last Table of Contents was issued.

You will find that all the pages of any one subject do not bear the same date. But the date following the subject listing in the Table of Contents is the **latest revision date for any of the pages included in that subject.**

Don't Destroy Table of Contents

When you replace the Table of Contents with a new one, **don't destroy the old one.** Sign it to show that you have read and understand all the subject matter it lists. Then turn it over to your Operations Officer to be placed in your Form 5 File.

Operations Officers Responsibilities

1. Operations Officers are responsible that every pilot attached to his base receives a copy of PIF and all revisions.
2. That every pilot on his base signs a compliance form certifying that he has read and understands all material contained in PIF and revisions.
3. That the compliance certificates (Form 24A and Form 24) are placed in the Form 5 Files of the individuals concerned.

When pilots turn in their Forms 24 at the end of the three-months period for which the Forms are the current Tables of Contents for PIF, the Operations Officer will see that previously dated Forms 24 and 24A which are in the Form 5 Files are removed and destroyed.

WANTED: Your Criticisms of PIF

May we call your attention to AAF Regulation 62-15, which directs all AAF establishments to submit items they desire to have included to the address given below. This also means any criticism of material already in PIF—corrections, questions of interpretation, and mistakes.

Our aim is to keep PIF accurate, current, and fully useful. If you can help us do that, we will appreciate it. Write direct to:

OFFICE OF FLYING SAFETY
Information Files Branch, Buhl Bldg.
Detroit 26, Michigan

TECHNICAL ORDERS

All pilots must know how to use the Technical Order files. Use of the Pilots' Information File does not obviate the need for using Technical Orders. The Pilots' Information File contains material of a general nature, and does not attempt to supply the specific engineering, maintenance and supply information contained in Technical Orders.

For detailed information on specific pieces of equipment, or how to operate types or models of airplanes, propellers, carburetors, generators, etc., you should read and follow the instructions found in Technical Orders.

What are Technical Orders?

AAF Technical Orders are directives published by order of the Commanding General, Army Air Forces, for the purpose of issuing specific instructions and information of a technical nature covering the operation, maintenance, storage, inspection, etc., of AAF equipment and materials, and for the establishment of a uniform system of files wherein such data will be readily accessible.

T. O. Numbering System

Every Technical Order has a series of three numbers separated by dashes, which identify the T. O. This identification number tells you three things about the T. O.:

The first number always has two digits. It corresponds to the AAF property classification number. For instance, if the first number in the T. O. designation is 05, the T. O. is concerned with instruments; if it is 02, it is something about engines and engine maintenance parts.

The only number that does not correspond to a property classification is 00, which is used for Technical Orders of a general nature, such as the Technical Order Index (which is 00-1), distribution of Technical Orders, inspection system, kits and such matters.

The property classifications which correspond to the initial number on Tech Orders are:

01- Airplanes and Maintenance Parts.
02- Engines and Maintenance Parts.
03- Aircraft Accessories.
04- Aircraft Hardware and Rubber Materials.
05- Aircraft Instruments.
06- Fuels and Lubricants.
07- Dopes, Paints and Related Materials.
08- Electrical Equipment and Supplies.
09- Aerial Targets and Gliders.
10- Photographic Equipment and Supplies.
11- Aircraft Combat Material.
12- Fuel and Lubricating Equipment and Supplies.
13- Clothing, Parachutes, Equipment and Supplies.
14- Hangars and Demountable Buildings.
16- Balloon Equipment and Supplies.
17- Machinery, Shop and Warehouse Equipment.
18- Special Tools.
19- Flying Field and Hangar Equipment.
21- Cordage, Fabrics and Leathers.
22- Woods.
23- Metal and Composition Material.
24- Chemicals.
25- Office Equipment and Supplies.
26- School Equipment.
27- Excess and Surplus Property.
29- Commercial Hardware and Miscellaneous Supplies.
30- Publications, Processed Motion Picture Films and Film Strips.

Complete breakdown of these classes is listed in T. O. 00-35A-1.

The second number of the Tech Order's identification represents the airplane or engine model, or the sub-division of the general property class identified by the first number. It is impractical to list here all the sub-divisions of each property classification; but to show how the system works, here is a breakdown of one classification, 03, Aircraft Accessories:

03-1	General
03-5	Electrical Equipment
03-10	Fuel System
03-15	Oil System
03-20	Propellers and Accessories
03-25	Wheels, Brakes and Struts
03-30	Air and Hydraulic System Accessories
03-35	Ice Eliminating Equipment
03-40	Control Units
03-45	Fire Extinguishers
03-50	Oxygen Equipment
03-55	CO_2 Inflation Equipment
03-60	Skiis
03-65	Accessory Power Plant

Such a breakdown for every property classification will be found in the T. O. Index (00-1) as the first item under each property classification number.

Sometimes the second number still does not give enough identification for you to find the equipment you are looking for, and it is necessary to use a letter after the number. For example: 03-10 identifies Fuel Systems. If you are looking for carburetors, however, you will find they are further separated by using B after 10—thus, 03-10B.

The third number usually is merely the serial number of the T. O. concerning the general subject identified by the first two numbers. There is one place, however, where the third number is an important addition to the identification, and that is in the series of airplane model manuals of operation, maintenance and repair, and parts catalogs.

These series of basic Tech Orders are identified as follows:

FIRST NUMBER	SECOND NUMBER	THIRD NUMBER
01 (the airplane)	–40A (the airplane model)	–1 (Handbook of Flight Operating Instructions)
01	–40A	–2 (Erection and Maintenance Manual)
01	–40A	–3 (Structural Repair Manual)
01	–40A	–4 (Parts Catalog)

Technical Order Index

The Technical Order Index, T. O. 00-1, is the first T. O. in the complete library. In the front of the Index you will find data listing the airplane and its engine, (airplane and engine cross-reference table) with identification of the manufacturer of each, and the Technical Order series covering each. Immediately behind it is the numerical index of Technical Orders.

Hunt first, in numerical sequence, for the basic number (for example, 01), then the second number (for example, 40A), then run through the serial numbers and titles until you find the title of Tech Order you are looking for. Go to the book containing the corresponding number to get your information. All Tech Orders are listed numerically.

Suppose you want to find a list of all the radio compasses in service and all of the Technical Orders pertaining to them. Turn to T. O. 00-2, "Alphabetical Index of AAF Equipment." Under "Compasses, Radio," you will find all types listed, together with numbers of applicable Technical Order Handbooks.

Where to Find a T. O.

Each Station, Base, or Sub-Depot has four complete files, assigned to the supply office, engineering office, technical inspector's office, and transient aircraft crew.

Complete information about T. O. files in overseas theaters is listed in T. O. 00-25-3.

Aircraft Files

The following Technical Orders and current amendments thereto must be maintained in each operating airplane:

1. T. O. 00-20A, Visual Inspection System for Airplanes.
2. T. O. 00-20A-2, Airplane Maintenance Instruction Form.
3. Pilot's Handbook of Flight Operating Instructions for the particular airplane model.
4. Erection and Maintenance Manual for the particular airplane.
5. Engine Handbook of Service Instructions for the particular engine.
6. Handbook of Weight and Balance Data.
7. T. O. 08-15-1, Radio Facility Charts.
8. T. O. 08-15-2, Radio Data and Aids to Airways Flying.
9. T. O. 08-15-3, Instrument Approach Procedures.

Compliance in Combat Areas

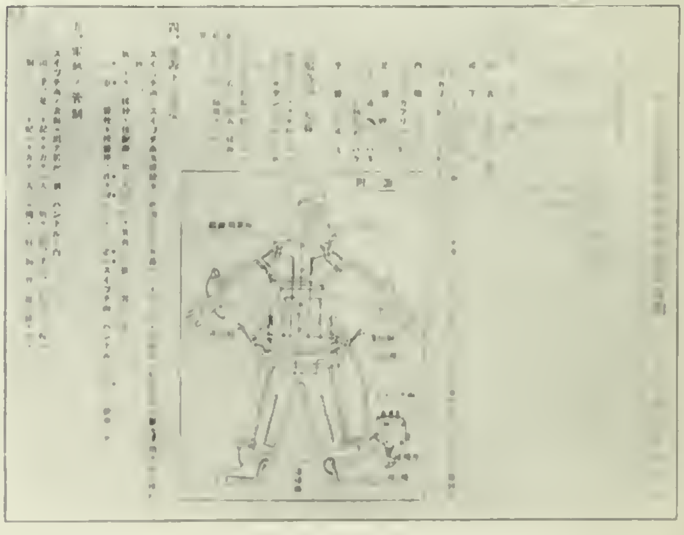
Compliance with Technical Orders and Technical Radiograms in combat areas will be subject to local conditions involving tactical employment of the equipment and at the discretion of the respective Air Force or Task Force Commanders concerned.

Remember

1. In this business, **nobody knows all the answers.**
2. The airplane is as important as you are. **Know your plane. Study everything you can find about it.**
3. Ignorance is dangerous. **Read your Handbook.**
4. One of the best ways to know your plane is to **keep tab frequently on new Technical Orders about the model you are flying.** It might save your neck some day.

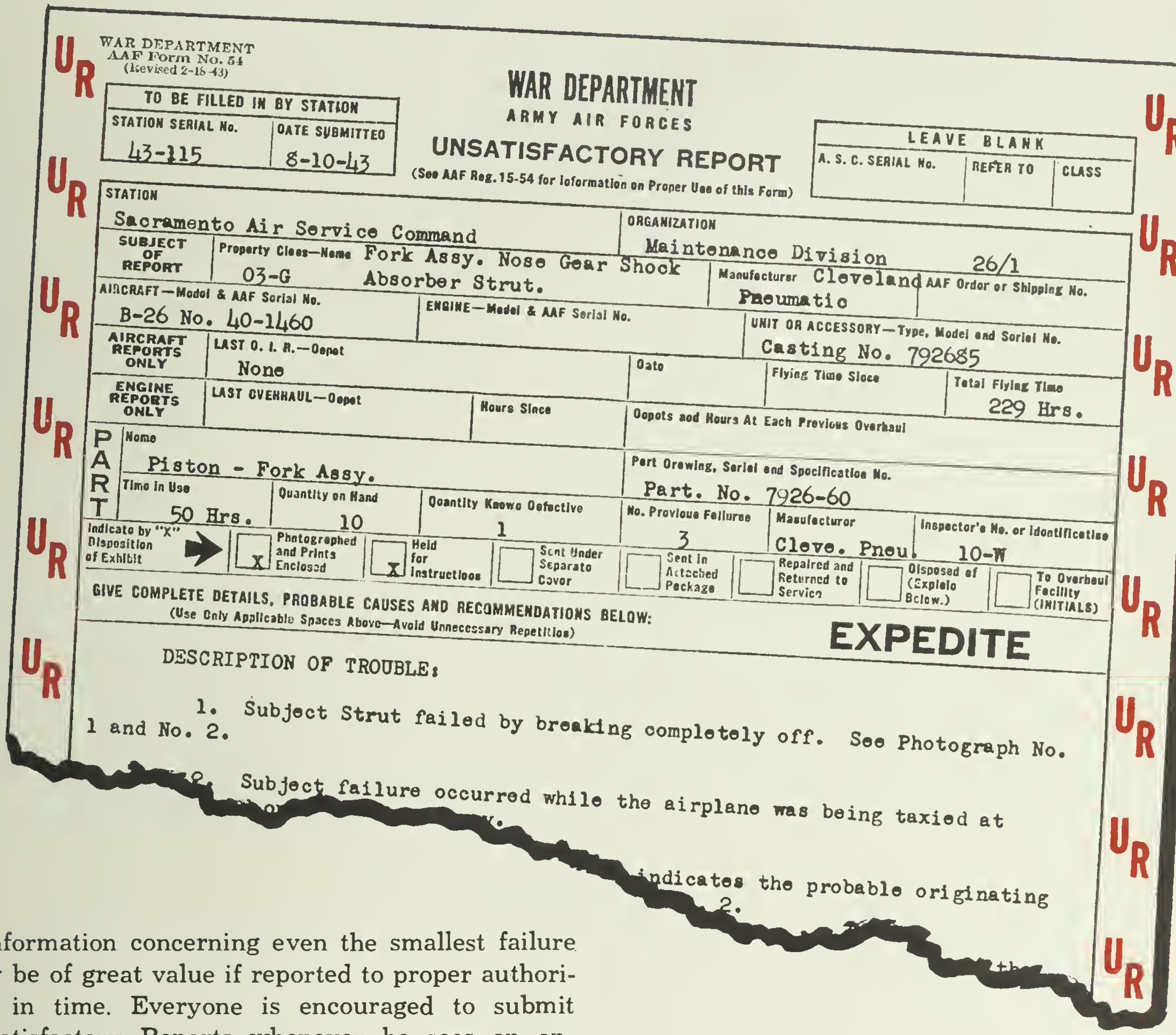
REFERENCE: Technical Order 00-5, dated October 7, 1942.

JAP TECH ORDER



IF YOU THINK OUR T. O.s ARE HARD TO READ—

UNSATISFACTORY REPORTS



WAR DEPARTMENT
AAF Form No. 54
(Revised 2-15-43)

WAR DEPARTMENT
ARMY AIR FORCES
UNSATISFACTORY REPORT
(See AAF Reg. 15-54 for Information on Proper Use of this Form)

TO BE FILLED IN BY STATION	
STATION SERIAL No.	DATE SUBMITTED
43-115	8-10-43

LEAVE BLANK		
A. S. C. SERIAL No.	REFER TO	CLASS

STATION
Sacramento Air Service Command

ORGANIZATION
Maintenance Division 26/1

SUBJECT OF REPORT
Property Class—Name 03-G Fork Assy. Nose Gear Shock Absorber Strut.

Manufacturer Cleveland Pneumatic

AAF Order or Shipping No.

AIRCRAFT—Model & AAF Serial No.
B-26 No. 40-1460

ENGINE—Model & AAF Serial No.

UNIT OR ACCESSORY—Type, Model and Serial No.
Casting No. 792685

AIRCRAFT REPORTS ONLY
LAST O. I. R.—Depot None
Date
Flying Time Since
Total Flying Time 229 Hrs.

ENGINE REPORTS ONLY
LAST OVERHAUL—Depot
Hours Since
Depots and Hours At Each Previous Overhaul

PART
Name Piston - Fork Assy.
Part Drawing, Serial and Specification No. Part. No. 7926-60
Time in Use 50 Hrs.
Quantity on Hand 10
Quantity Known Defective 1
No. Previous Failures 3
Manufacturer Cleve. Pneu.
Inspector's No. or Identification 10-W

Indicate by "X" Disposition of Exhibit ➔ ☒ Photographed and Prints Enclosed ☒ Held for Instructions ☐ Sent Under Separate Cover ☐ Sent in Attached Package ☐ Repaired and Returned to Service ☐ Disposed of (Explain Below.) ☐ To Overhaul Facility (INITIALS)

GIVE COMPLETE DETAILS, PROBABLE CAUSES AND RECOMMENDATIONS BELOW:
(Use Only Applicable Spaces Above—Avoid Unnecessary Repetition)

EXPEDITE

DESCRIPTION OF TROUBLE:

1. Subject Strut failed by breaking completely off. See Photograph No. 1 and No. 2.

2. Subject failure occurred while the airplane was being taxied at

indicates the probable originating
2.

Information concerning even the smallest failure may be of great value if reported to proper authorities in time. Everyone is encouraged to submit Unsatisfactory Reports whenever he sees an opportunity to contribute to greater efficiency by suggesting correction of faults.

As a pilot, you are in close touch with both methods and machines. A great ground organization is behind the men who fly. But both flying and ground operations always can be improved. **Unsatisfactory Reports** are designed to speed improvements and to permit the individual to present a maintenance problem and his suggested correction, through channels.

Unsatisfactory Reports usually fall into these general classes:

1. Failure of equipment.
2. Unsatisfactory design.
3. Defects due to faulty material, workmanship, or inspection.
4. Unsatisfactory maintenance or supply methods, systems, or forms.

How to Prepare a U. R.

AAF Form No. 54, obtainable from the Engineering Officer, is used for Unsatisfactory Reports.

Each report must be a complete description of an individual case. It must explain the unsatisfactory condition, including all pertinent information, to enable investigation and correction of the trouble reported without the need for further requests for information. See AAF Regulation 15-54 for details about how to file different types of U.R.'s.

Coordination

All Unsatisfactory Reports originating at a station are routed through the Engineering Officer, who investigates and enters his endorsement. He sends the U.R. to the Commanding General, Air Service Command at Patterson Field, Fairfield, Ohio.

FLYING ON A RED DIAGONAL

Before takeoff check all information on Form 1A. If "STATUS TODAY" is indicated by a red diagonal or red dash, make sure that a properly authorized officer has signed the exceptional release.

This exceptional release may be signed by the Engineering or Maintenance Officer. If it is impractical for such officer to sign the release, the Pilot is authorized to sign it.

Warning

Don't sign the exceptional release until you know exactly what is wrong with the airplane or its equipment. Make sure that you know what is represented by the red symbol. Check Form 41B for additional information on the condition of your plane.

Other Warnings

When an airplane is undergoing work or has parts removed for repair and such status is not readily apparent without careful inspection, appropriate tags will be used by squadron engineering officers in some cases. This applies particularly when work of this nature is performed at other than regularly established air bases.

A red tag secured conspicuously on the control column or ignition switch will bear a notation, "Not to be flown until generator (or radio, carburetor, etc., as the case may be) has been replaced or repaired." This will warn any pilot who might attempt a takeoff without knowledge that the airplane is not ready for tactical flight.

Another tag will be secured at or near the location from which parts have been removed. This will permit ready identification for service crew or mechanic.

A Word to the Wise

Red means danger. Get the facts before you fly.

What Symbols Mean		
	╱	A red diagonal shown under "Status Today" on 1A indicates that the airplane is flyable, but is not in perfect condition.
	✚	A red cross indicates that a major defect exists and the airplane must not be flown.
	━	A red dash indicates required inspection has not been made.
	Like red traffic lights, these symbols are primarily for your protection.	

Transition Flying Training

Commanding officers of Army Air Forces stations and organizations will make available to pilots Handbooks, Technical Orders, Operation and Flight Instructions, Special Instructions on Equipment, and all other such publications; and will require that all pilots under their control pursue a prescribed course of transition flying instruction, fitted to the pilot's previous experience, and pass definite tests, when initially assigned to fly aircraft having flying characteristics and controls or equipment with which the pilot is not thoroughly familiar. The scope and duration of this course will be such as to thoroughly qualify the pilot to operate the aircraft safely and efficiently. This course of transition training will cover all maneuvers essential for the safe and efficient operation of the aircraft; in the case of multi-engined aircraft, this course will include flying on the minimum number of engines required to maintain flight during an emergency.

Pilots reporting to an Army Air Forces station other than their home station or to an aircraft factory for ferry duty will demonstrate satisfactory operative knowledge of the type to be flown, to the commanding officer or his representative at that station or to the Army Air Forces representative at the factory. The pilot's statement that entry has been made on his Form 5 to the effect that he is qualified on the type of airplane to be flown, may be accepted provided he has flown the type within the last 30 days.

Pilots operating aircraft in an organization or at a station other than their own will be required to comply with these instructions.

A certificate recording the action taken as directed above, will be prepared under the direction of the commanding officer and filed with the pilot's Form 5 record.

REFERENCE: AAF Regulation 50-16, dated October 26, 1942. This regulation supersedes AC Circular 50-4, dated May 9, 1941

Instrument Flying

A twin-engine airplane operating on one engine is only half an airplane. A pilot not proficient in instrument flying is only half a pilot. There is no place in the AAF today for a pilot who can fly merely by contact rules. Contact flying is part of the game, but by itself it has become an increasingly small part. The majority of all tactical missions require instrument proficiency.

To be of any real value to your organization and to safeguard your own life, you must become a proficient instrument pilot. Weather does not wait for war, nor war for weather. Sooner or later you will encounter conditions in flight where you will be paid back in full for whatever effort you have expended on instrument training.

Regulations demand that you have a certain amount of instrument training. Consider these requirements only the beginning of your instrument experience. Remember, there is nothing superhuman about flying an airplane by instruments. **If you are already a competent contact pilot, it will take only personal initiative and perseverance to become a competent instrument pilot.**

The Attitude System

Attitude may be defined as the relation of the airplane to the horizon. Maintaining a desired attitude in contact flight is easy because you can see the horizon. Through the proper use of instruments, however, **you can reconstruct the horizon on your cockpit panel, and know the exact attitude of your airplane at any moment.**

The old 1-2-3 system (needle, ball, airspeed) of instrument flying proved inadequate because the pilot flew mechanically. **Today's attitude, or full-panel, system teaches you to read all of your instruments in relation to the attitude of your airplane. Thus, you obtain a clear mental picture of your condition of flight.** This may prove difficult in the early stages of instrument training, but later it becomes as automatic as the handling of your controls.

You will learn not to depend on any single instrument if it fails to operate correctly. Instead you will depend on your **flight instruments as a coordinated whole** and realize it is possible to cross-check the attitude of your airplane by **combinations of instruments.** For example, your artificial horizon, which indicates most realistically your airplane's attitude, is not the only picture of attitude. You can further check banks by the turn indicator and directional gyro, and pitch by the altimeter and airspeed indicator. Hence the expression "full-panel."

Instrument Certificates

The AAF issues two certificates, one white, one green to denote instrument pilot proficiency ratings.

If you are a rated pilot on active duty, assigned to the pilotage of Army aircraft, you must obtain a currently valid white instrument card (AAF Form 8). If you do not already hold one, this rating is obtained by taking the Instrument Flying Course and passing the Instrument Flight Test and Oral Examination prescribed in AAF Reg. 50-3.

Read AAF Reg. 50-3 carefully in order to understand details of the course and the test.

The attainment of a green card (AAF Form 8A) is not demanded by regulation. It may be regarded as a goal to be reached by the pilot with long instrument experience. Under no circumstances will a green card be issued to a pilot with less than 1500 total hours which must include 100 hours of actual instrument time. These are bare minimums and station commanders must use great care in proving the applicant's proficiency once he has filled these basic requirements.

The table on PIF 1-9-3 shows the relative tests which must be passed to attain either card. Either flight test is given only after the pilot has pursued the prescribed Instrument Flying Course or that part of it necessary to complete the test.

THESE ARE YOUR BIBLES OF INSTRUMENT FLYING

GET THEM! READ THEM! KNOW THEM!

Below are your navigational aids to instrument flight. Be sure they are in your airplane before flying cross-country on instruments.

T.O. 30-100A-1

TECHNICAL ORDER NO. 30-100A-1

INSTRUMENT FLYING
Basic

T.O. 30-100B-1

TECHNICAL ORDER NO. 30-100B-1

INSTRUMENT FLYING
Advanced

T.O. 30-100C-1

TECHNICAL ORDER NO. 30-100C-1

INSTRUMENT FLYING
Instrument Trainer

T.O. 30-100D-1

TECHNICAL ORDER NO. 30-100D-1

INSTRUMENT FLYING
Technique in Weather
1 JAN 1944

ARMY AIR FORCES
RADIO FACILITY
CHARTS

ARMY AIR FORCES
INSTRUMENT LETDOWN
PROCEDURES

JANUARY 1944

ARMY AIR FORCES
RADIO DATA
AND
FLIGHT INFORMATION

INSTRUMENT FLIGHT TESTS AND REQUIREMENTS FOR RATINGS

A board of competent instrument pilots delegated by the Commanding Officer of each AAF station or equivalent unit will give the flight tests and oral examinations.

FOR WHITE CARD

(AAF Form 8)

1 Instrument Flying Course and Oral Examination (prescribed in AAF Reg. 50-3)

2 Basic Maneuvers
- a. Spiral Climbs
- b. Level Flight
- c. 90° and 180° Turns
- d. Steep Banks
- e. Stalls
- f. Recovery from Unusual Positions
- g. Glides

3 Radio Range Employment
- a. Orientation
- b. Beam Bracketing
- c. Let-Down and Low Approach

FOR GREEN CARD

(AAF Form 8A)

1 Prerequisites: 100 hours flying in actual instrument weather conditions, airplane flown manually. (On top flight cannot be logged for green card time.) A minimum of 1500 hours as pilot.

PLUS

The same as for white card

2 The same as for white card

PLUS

Instrument Take-Off

3 The same as for white card

PLUS
- a. Position Plotting by Intersection
- b. Aural Null Orientation, and Homing to station
- c. Radio Compass Low Approach

Certificate Renewals

Instrument certificates must be renewed yearly. To renew the green card the pilot must have flown 12 hours during the year under actual weather conditions, but it must be divided so that he has flown 6 hours in each six months' period of the year. There is no weather requirement for renewing white cards.

On top flight cannot be logged as actual weather time for a green card renewal.

Revoking Ratings

Organization Commanders may revoke instrument certificates at any time if a pilot's instrument proficiency is not satisfactory.

All green certificates issued before March 6, 1944, are rescinded. To requalify pilots must obtain them under provisions of the current AAF Reg. 50-3.

Maintaining Instrument Proficiency

There are three ways to maintain instrument proficiency:

1. Actual flights under instrument weather conditions.
2. Hooded Flight (as governed by the safety precautions prescribed in AAF Reg. 60-4).
3. Instrument Trainer.

Use all three, but make the gaining of actual weather flying experience your first choice.

The instrument trainer will keep you familiar with procedure. Hooded flight is valuable to familiarize you with your own type of equipment. However, neither of them can replace the self-confidence and relaxation that grow out of **actual instrument flight.**

Increase your proficiency to its utmost. Do not be satisfied with merely qualifying for a certificate.

TIME CREDIT

Official military flying time and time spent in training devices are recorded on AAF Forms 1, 1G, 5, and 5S (students). Form 1G is used for glider pilots.

Detailed information covering entries which pilots have to make on the Form 1 is included in AAF Reg. 15-1 and its amendments. Information on the recording of individual flying time is contained in AAF Reg. 15-5 and its amendments. Read both regulations for a full understanding of Time Credit.

Computing Flying Time

Flying time for any one aerial flight starts when the airplane begins to move forward on the takeoff run and ends after airborne flight when the airplane is on the ground and any one of these three things occurs:

1. The engines are stopped, or
2. The airplane becomes stationary with engines in operation for a period or periods totaling more than five minutes, or
3. A change is made in the crew.

A series of practice landing flights is considered as one flight. Therefore, a series of practice landings in which none of the above three things occurs shall be treated as one flight in entering time credit on the Form 1. (Note: Be sure to record number of landings.)

The following information is a guide to the proper use of duty symbols on the Form 1.

FIRST PILOT TIME (P)

All qualified pilots who are actually flying in the capacity of first pilot get First Pilot Time.

Only one pilot at a time may claim First Pilot Time. **A copilot shall be credited with First Pilot Time for that portion of any flight in which he controls fully the operation of the airplane.**

See Flying Instructor Time below.

COPILOT TIME (CP)

All qualified pilots who are actually flying in the capacity of copilot get Copilot Time. It can be credited only in aircraft equipped with dual controls, side-by-side arrangement.

COMMAND PILOT TIME (C)

Command Pilot Time is given to a pilot holding a currently effective Command Pilot rating when he is on a flight for which a copilot is authorized; or when on a flight for which a copilot is not authorized he is acting in the capacity of Command Pilot in unit operations of two or more airplanes. The symbol cannot be used if the pilot concerned is actually at the controls as pilot or copilot. Only one person at a time in the airplane may be credited with this time.

ACTING COMMAND PILOT TIME (CA)

An individual holding the rating of Senior Pilot, Pilot, Senior Service Pilot, or Service Pilot, when flying in the capacity of Command Pilot in unit operations of two or more airplanes, gets Acting Command Pilot Time.

QUALIFIED PILOT DUAL TIME (QD)

This time is credited to any qualified pilot who is receiving any type of dual instruction, such as transition training, instrument training, check time, or refresher course, and to pilots taking instructors' courses.

FLYING INSTRUCTOR TIME (S)

This time is credited to all qualified pilots giving flying instructions **to students or rated pilots** on flights of a prescribed course of pilot training within the AAF Training Command, a prescribed course of instrument training, or a prescribed course of transition flying at AAF activities. This includes giving flight checks **to students or rated pilots.**

Although you use only the symbol (S) on Form 1 when giving flying instruction you actually receive both Instructor Time (S) and First Pilot Time (P) on your Form 5.

STUDENT FIRST PILOT TIME (SP)

A student pilot engaging in a solo flight is credited with this time. (A solo flight here means one in which an instructor is not participating in any way except possibly as a passenger.)

STUDENT DUAL TIME (SD)

This time is credited to student pilots when flying with and receiving dual instruction from an instructor in the same airplane.

STUDENT COPILOT (SC)

A student pilot flying in the capacity of and performing the duties of a copilot gets this time.

NON-PILOTS AND NON-PILOT STUDENTS

Time symbols used for non-pilots and non-pilot students are found on the inside front cover of Forms 1 and 1G.

RADIO CONTROL PILOT TIME (RP)

This time is credited to rated pilots performing duties as Radio Control Pilots in radio-controlled or control aircraft, as follows:

(1) Pilots in the controlled aircraft either at the flight controls or acting as safety pilot are credited with both Radio Control Pilot Time and First Pilot Time.

(2) Pilots at the radio controls in the control aircraft are credited with Radio Control Pilot Time only.

Duty Change Aloft

If during a flight or series of flights any occupant changes his duty position, the time elapsed must be entered under the duty symbol and the new duty symbol entered in the next column on the Form 1.

Symbol for Type of Flight

The following symbols indicate the type of flight performed. You must enter them on the Form 1 along with the number of hours and minutes flown under each condition. The symbol N covers night flying; I is for instrument flight and hooded flight; NI indicates instrument flight at night; the symbol AI is used for flight in actual instrument conditions, and the symbol NAI is used for flight in actual instrument conditions at night. Contact flight requires no symbol. Each time you change the symbol for type of flight, enter it for each occupant except passengers.

Log actual instrument time for flight conducted "in the soup," when the airplane is manually controlled. This means you can log AI or NAI time on the Form 1 only while you are flying **in an overcast on instruments. Flight over a solid overcast, for example, would constitute instrument flight (I), but could not be logged** as **actual instrument time (AI). Actual instrument time cannot be logged unless the airplane is being flown manually.**

AERONAUTICAL RATINGS

Officers, warrant officers, flight officers, and enlisted men of the AAF and officers, warrant officers, and enlisted men of the AUS assigned to air observation of the Field Artillery, who have demonstrated the required qualifications may, under prescribed regulations, be given aeronautical ratings.

Flying Officers—A flying officer is an officer who has received an aeronautical rating as a pilot of aircraft, as an aircraft observer, or as any member of a combat crew. For duration and 6 months this includes Flight Surgeons, and commissioned officers and warrant officers while undergoing flight training.

Flight Officers—An aviation cadet, at the completion of training may, if not selected for appointment as Second Lieutenant, be appointed a Flight Officer, with pay and allowances of Warrant Officer, Junior Grade, on flying status. After three months he may be appointed by selection to Second Lieutenant.

Command of Flying Units—Any flying officer on duty with the AAF who has an aeronautical rating as a pilot of service types aircraft is competent to command flying units.

Only an officer with an aeronautical rating of Command Pilot, Senior Pilot, Pilot, Senior Balloon Pilot, or Balloon Pilot may command tactical units of the AAF where a comprehensive knowledge of flying on the part of the commander is necessary. A Service Pilot officer may command air transport units or units equipped solely with liaison or glider aircraft. A Liaison Pilot officer may command only organizations equipped solely with liaison aircraft. A Glider Pilot officer may command only organizations equipped solely with glider aircraft.

Flight Status—To retain flight status, one of the following categories must be filled periodically, as minimum flight requirements:

1. Monthly: 10 flights totaling 3 hours, or a total of 4 hours in the air. Or
2. During 2 consecutive months: 20 flights totaling 3 hours, or a total of 8 hours in the air. Or
3. During 3 consecutive months: 30 flights totaling 9 hours, or a total of 12 hours in the air.

Suspension from Flying Duty

Suspensions from flying status are of three types:

1. Grounding—anticipated to last 30 days or less. A pilot may be grounded or returned to flying duty from that status by his Commanding Officer.
2. Temporary suspension—anticipated to last 6 months or less. May be initiated by a pilot's Commanding Officer, but must be confirmed or removed by the Commanding General of the air force or independent AAF Command having jurisdiction over the pilot.
3. Indefinite suspension—anticipated to last over 6 months. May be initiated by the Commanding Officer but must be confirmed and can be removed only by the Commanding General of the AAF.

Suspensions may be removed only by revoking or rescinding them. If revoked, the pilot can draw flying pay for the period of suspension if he meets flight requirements. If rescinded, he cannot draw flying pay for the period of suspension. Suspension for sickness or injury ordinarily will be revoked; in other cases usually it will be rescinded.

A pilot injured in an aircraft accident is entitled to flight pay for a 3-month period without meeting flight requirements. This period begins on the first of the month of injury if flight requirements have not been met, on the first of the month following if flight requirements have been met by the pilot at the time of the accident. The pilot will not be suspending from flying status until the end of the 3-month period. If, at the end of such period, he is still unable to perform his flying duties, he will then be given an indefinite suspension.

Applications and Rerating

When an individual determines he is eligible for an aeronautical rating, he should forward his application through channels.

A Service Pilot or Senior Service Pilot may apply to the rating board of his station for a Pilot rating. The board determines, without a flight check, if the applicant is qualified for rerating. It forwards its report through channels to the headquarters of the Air Force or Command having jurisdiction. That headquarters acts on the application; if favorable, the applicant is notified when and where to report for a flight check.

Computing Flying Time

Credit flying time when making application for aeronautical ratings, as follows:

In military or naval heavier-than-air aircraft, as pilot or copilot . . . . .100%.

Acting in capacity of command pilot, though not rated as such and not at the controls, in unit operations of two or more aircraft . . . . 100%.

All other flying time in military or naval aircraft . . . . .50%.

Military or naval lighter-than-air aircraft . . 25%.

Pilot or copilot in commercial heavier-than-air aircraft, power rating at least 400 hp . . . . . 100%.

Applying for Ratings

Submit complete information to show that you possess all the qualifications for the rating requested. Include a copy of your latest AAF Form 5, certified by the operations officer, to substantiate flying time for which you claim credit.

Flying time in non-military aircraft powered with engines of at least 400 hp will be credited only when the number of hours for which you claim credit is entered in the correct horsepower column on Form 5, or if a certificate by the operations officer, indicating the number of hours claimed, is placed on the face of the Form 5.

Include a statement of service, to substantiate service while holding an aeronautical rating. If you left the service at any time, then re-entered the service, claim credit only from the date of rerating. This may differ from the date of recommission.

Qualifications for New Ratings

Here is a brief summary of the qualifications for higher aeronautical ratings. Before you apply for rerating, refer to the detailed requirements in AAF Regulation 50-7. To obtain the rating of:

Command Pilot—You must hold the rating of Senior Pilot or Pilot and have one of the following:

1. 15 years active duty as a rated pilot, with 2000 hours of flying time.
2. 10 years active duty as a rated pilot, with 3000 hours of flying time.
3. 20 years Reserve or National Guard service as a rated pilot, with 2000 hours of flying time.
4. 15 years Reserve or National Guard service as a rated pilot, with 3000 hours of flying time.

Senior Pilot—Hold the rating of Pilot, with at least 5 years Regular Army, Reserve, or National Guard service and have 1500 hours flying time.

Pilot, Conversion from Senior Service or Service Pilot—You must be at least 18 but not over 38 years old, not above the rank of Captain, and hold a rating of Senior Service Pilot or Service Pilot. In addition, have 500 hours of pilot time, 400 hours of that in airplanes with engines of at least 400 hp, 300 hours alone except where a copilot is required, 100 hours or more in AAF aircraft with 400 hp engines, with 50 hours in the last 12 months. Board recommendation and flight test also are required.

Aircraft Observer—If you hold the rating of Command Pilot, Senior Pilot, Pilot, Senior Balloon, or Balloon Pilot you may qualify for Aircraft Observer if you:

1. Have served as a regular member of a combat crew in observation or reconnaissance aviation units of the AAF or National Guard as a commissioned officer and a pilot for not less than one year. Have at least 100 hours in observation or reconnaissance, at least 50 hours of which were as observer. Qualify as expert aerial gunner or aerial sharpshooter. Be certified by your Commanding Officer.
2. Aircraft Observer (Navigator)—Complete a course in aerial navigation. Qualify as expert aerial gunner or aerial sharpshooter. Be certified as qualified by your Commanding Officer.
3. Aircraft Observer (Bombardier)—Qualify as Bombardier, 1st class, 2nd class, or 3rd class, in prescribed bombing courses. Qualify as expert aerial gunner or aerial sharpshooter. Be certified as qualified by your Commanding Officer.

Other Ratings—Complete qualifications for other ratings and for rerating may be found in AAF Regulation 50-7.

Warning

Submit your application for rating or rerating through the proper channels. You are not rated until you have been notified officially. You must be able to present official proof of your rating before you are entitled to wear the wings of that rating.

REFERENCES: AR 95-60; AR 35-1480; AAF Regs. 50-7 and 35-16; TM 14-250.

REPORTING AIRCRAFT ACCIDENTS

Duty Required

The Flight Commander or senior member not incapacitated will, after an aircraft accident involving military personnel only:

1. Secure necessary medical attention or undertaker services.

2. Report to the Commanding Officer of the nearest Air Forces station: location of accident, nature and cause of accident, assistance required, extent of injury to personnel, action taken to care for injured, place at which injured can be reached, and any other pertinent information.

3. Secure all available evidence and testimony of witnesses, etc., which may serve to determine the cause of the accident.

4. See that the wreckage is not moved or tampered with in any way until an investigation has been made, except when necessary to assist persons injured or trapped in the wreckage, or in the interest of public safety.

5. Secure the necessary guard for the aircraft.

When an accident has occurred at or near an Army station, secure the guard from the C. O.

If the accident has occurred at a distance from any Army station, secure the guard from civilian sources at the local rate of pay for each caretaker. (The pay of civilian caretakers will be handled on AAF Form 15, and will be forwarded promptly to the home station of the airplane for payment.)

6. Take necessary action for the disposition of the airplane and the return of personnel to their stations.

7. In case of damage to private property the investigation will be made by the claims officer of the home station or the station nearest the scene of the accident. In reporting the accident ask that the claims officer be notified.

8. Upon return to home station, submit a full report to the Commanding Officer.

Public Relations Policy

Make no statement to the press about any accident. The C.O. of the station or base nearest the scene of the accident will issue whatever information is to be released for publication. Don't talk to unauthorized persons about the accident nor the flight involved.

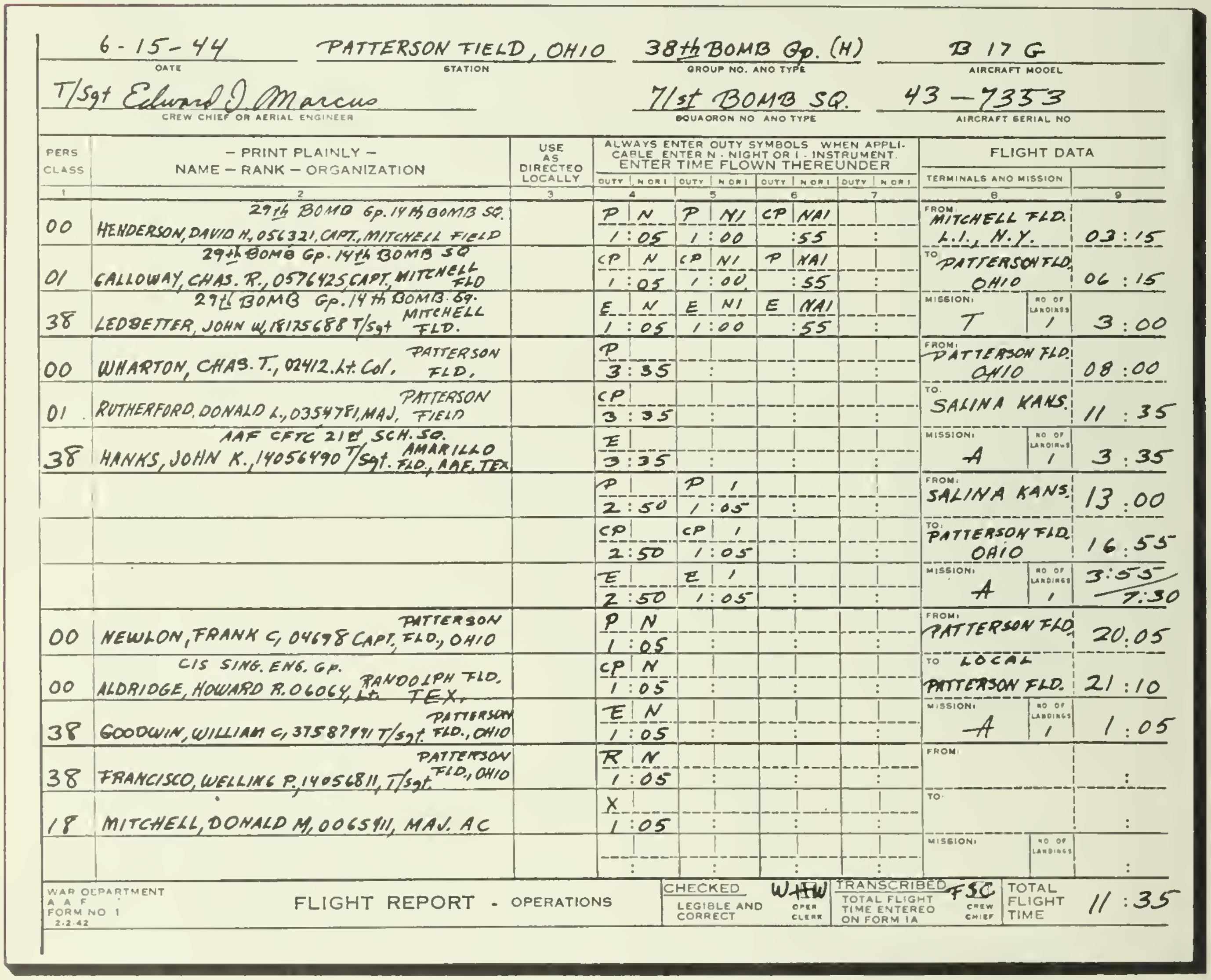
While in charge of wreckage not on Government property, do not interfere with representatives of the press who may take photographs or cover the news story, provided they do not disturb the wreckage. The use of material they gather or photos they take is covered by the censorship code and is not your responsibility.

REFERENCE: AAF Reg. 62-14. AAF Reg. 62-14A, AR 95-120, WD Circular 230.

Forms

The pilot is responsible for the proper execution of a number of forms, and shares responsibility in others. In order that you may know how to fill them out properly and recognize what is of importance to you on forms that others fill out, these typical forms, properly executed, are presented.

You will enter each flight you make, with all necessary details, on a Form 1. A book of Form 1's belongs in every airplane.



6-15-44 — DATE
PATTERSON FIELD, OHIO — STATION
38th BOMB Gp. (H) — GROUP NO. AND TYPE
B 17 G — AIRCRAFT MODEL
T/Sgt Edward J. Marcus — CREW CHIEF OR AERIAL ENGINEER
71st BOMB SQ. — SQUADRON NO. AND TYPE
43 — 7353 — AIRCRAFT SERIAL NO.

PERS CLASS 1	– PRINT PLAINLY – NAME – RANK – ORGANIZATION 2	USE AS DIRECTED LOCALLY 3	ALWAYS ENTER DUTY SYMBOLS WHEN APPLICABLE. ENTER N - NIGHT OR I - INSTRUMENT. ENTER TIME FLOWN THEREUNDER — DUTY, N OR I 4	DUTY, N OR I 5	DUTY, N OR I 6	DUTY, N OR I 7	FLIGHT DATA — TERMINALS AND MISSION 8	9
00	29th BOMB Gp. 14th BOMB SQ. HENDERSON, DAVID H., 056321, CAPT., MITCHELL FIELD		P N 1:05	P NI 1:00	CP NAI :55	:	FROM: MITCHELL FLD. L.I., N.Y.	03:15
01	29th BOMB Gp. 14th BOMB SQ GALLOWAY, CHAS. R., 0576425, CAPT., MITCHELL FLD		CP N 1:05	CP NI 1:00	P NAI :55	:	TO: PATTERSON FLD, OHIO	06:15
38	29th BOMB Gp. 14th BOMB Sq. LEDBETTER, JOHN W., 18125688 T/Sgt MITCHELL FLD.		E N 1:05	E NI 1:00	E NAI :55	:	MISSION: T — NO. OF LANDINGS: 1	3:00
00	WHARTON, CHAS. T., 02412. Lt. Col. PATTERSON FLD.		P 3:35	:	:	:	FROM: PATTERSON FLD. OHIO	08:00
01	RUTHERFORD, DONALD L., 0354781, MAJ., PATTERSON FIELD		CP 3:35	:	:	:	TO: SALINA KANS.	11:35
38	AAF CFTC 21st SCH. SQ. HANKS, JOHN K., 14056490 T/Sgt. AMARILLO FLD., AAF, TEX		E 3:35	:	:	:	MISSION: A — NO. OF LANDINGS: 1	3:35
			P 2:50	P I 1:05	:	:	FROM: SALINA KANS.	13:00
			CP 2:50	CP I 1:05	:	:	TO: PATTERSON FLD. OHIO	16:55
			E 2:50	E I 1:05	:	:	MISSION: A — NO. OF LANDINGS: 1	3:55 7:30
00	NEWLON, FRANK C., 04698 CAPT., PATTERSON FLD., OHIO		P N 1:05	:	:	:	FROM: PATTERSON FLD.	20.05
00	CIS SING. ENG. GP. ALDRIDGE, HOWARD R. 06064, Lt. RANDOLPH FLD. TEX.		CP N 1:05	:	:	:	TO: LOCAL PATTERSON FLD.	21:10
38	GOODWIN, WILLIAM C., 37587991 T/Sgt. PATTERSON FLD., OHIO		E N 1:05	:	:	:	MISSION: A — NO. OF LANDINGS: 1	1:05
38	FRANCISCO, WELLING P., 14056811, T/Sgt. PATTERSON FLD., OHIO		R N 1:05	:	:	:	FROM:	:
18	MITCHELL, DONALD M., 0065911, MAJ. AC		X 1:05	:	:	:	TO:	:
			:	:	:	:	MISSION: — NO. OF LANDINGS:	:

WAR DEPARTMENT A.A.F. FORM NO. 1 2-2-42	FLIGHT REPORT - OPERATIONS	CHECKED LEGIBLE AND CORRECT W.H.W. OPER. CLERK	TRANSCRIBED TOTAL FLIGHT TIME ENTERED ON FORM 1A F.S.C. CREW CHIEF	TOTAL FLIGHT TIME 11:35

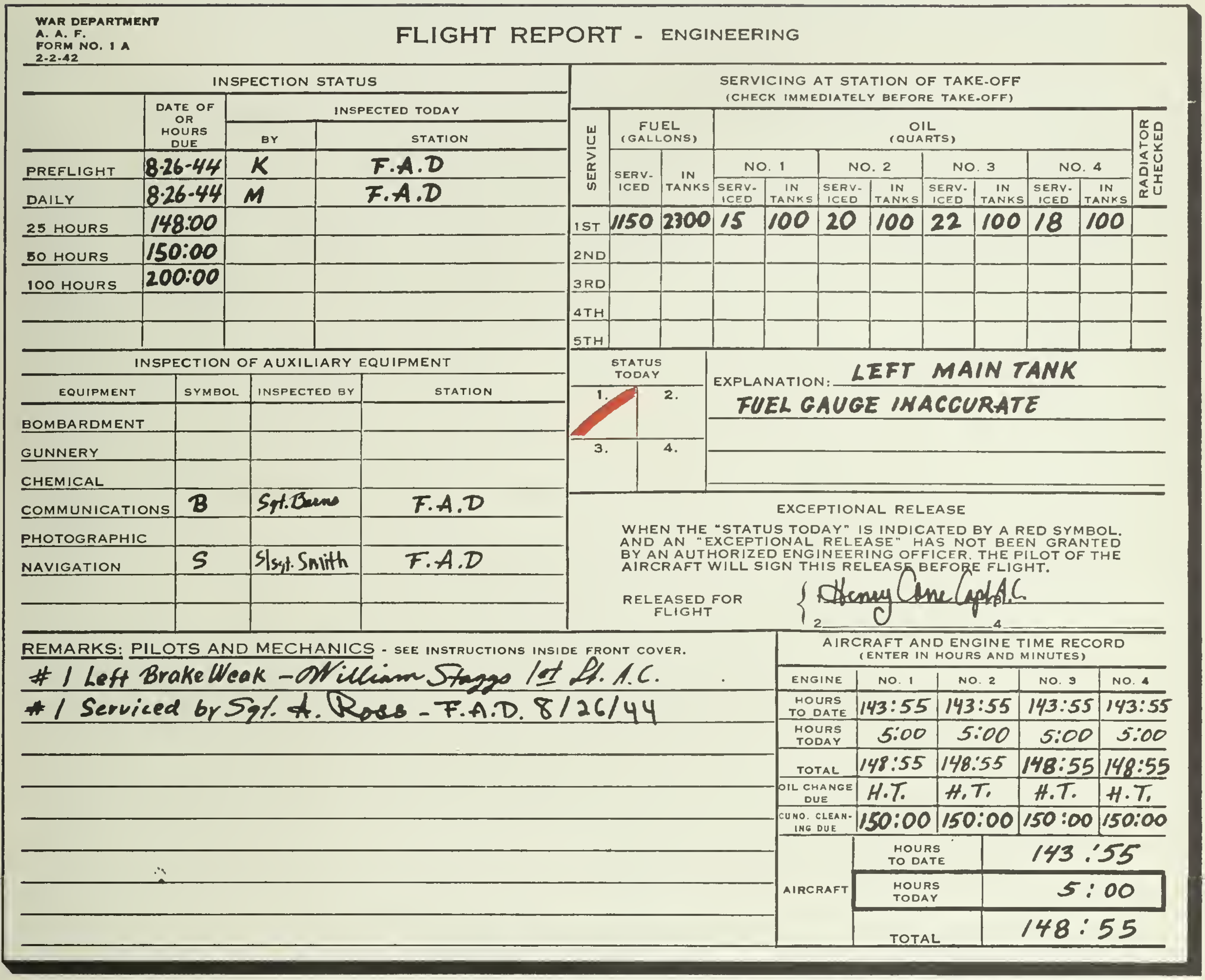
The crew chief ordinarily fills out the top lines. Check the entries as soon as you enter the cockpit. Fill in data required on each member of the flight, and as much data on the flight as possible before takeoff.

Each time you land, and before you leave the cockpit complete the Form 1. For instance, if you are on a cross country flight, fill in the information on each leg of the trip. Don't wait until you reach your destination and then try to remember all the details of time credit and duty status. **Every time you come to a stop on the ground you have a date with your Form 1.**

Be sure that all enlisted men on flying status are properly credited with the right duty symbol, so they will receive credit for their time.

Use column 3 as directed locally. Your C.O. may direct you to write your organization there, instead of as shown.

For details on time credit and duty symbols see PIF 1-10.



WAR DEPARTMENT
A. A. F.
FORM NO. 1 A
2-2-42

FLIGHT REPORT - ENGINEERING

INSPECTION STATUS

	DATE OF OR HOURS DUE	INSPECTED TODAY BY	INSPECTED TODAY STATION
PREFLIGHT	8-26-44	K	F.A.D
DAILY	8-26-44	M	F.A.D
25 HOURS	148:00		
50 HOURS	150:00		
100 HOURS	200:00		

SERVICING AT STATION OF TAKE-OFF
(CHECK IMMEDIATELY BEFORE TAKE-OFF)

SERVICE	FUEL (GALLONS)		OIL (QUARTS)								RADIATOR CHECKED
			NO. 1		NO. 2		NO. 3		NO. 4		
	SERV-ICED	IN TANKS	SERV-ICED	IN TANKS	SERV-ICED	IN TANKS	SERV-ICED	IN TANKS	SERV-ICED	IN TANKS	
1ST	1150	2300	15	100	20	100	22	100	18	100	
2ND											
3RD											
4TH											
5TH											

STATUS TODAY

1. /	2.
3.	4.

EXPLANATION: LEFT MAIN TANK
FUEL GAUGE INACCURATE

INSPECTION OF AUXILIARY EQUIPMENT

EQUIPMENT	SYMBOL	INSPECTED BY	STATION
BOMBARDMENT			
GUNNERY			
CHEMICAL			
COMMUNICATIONS	B	Sgt. Burns	F.A.D
PHOTOGRAPHIC			
NAVIGATION	S	S/Sgt. Smith	F.A.D

EXCEPTIONAL RELEASE

WHEN THE "STATUS TODAY" IS INDICATED BY A RED SYMBOL, AND AN "EXCEPTIONAL RELEASE" HAS NOT BEEN GRANTED BY AN AUTHORIZED ENGINEERING OFFICER, THE PILOT OF THE AIRCRAFT WILL SIGN THIS RELEASE BEFORE FLIGHT.

RELEASED FOR FLIGHT
1. Henry Crane Capt. A.C. 3.
2. 4.

REMARKS: PILOTS AND MECHANICS - SEE INSTRUCTIONS INSIDE FRONT COVER.

#1 Left Brake Weak — William Staggs 1st Lt. A.C.
#1 Serviced by Sgt. A. Ross — F.A.D. 8/26/44

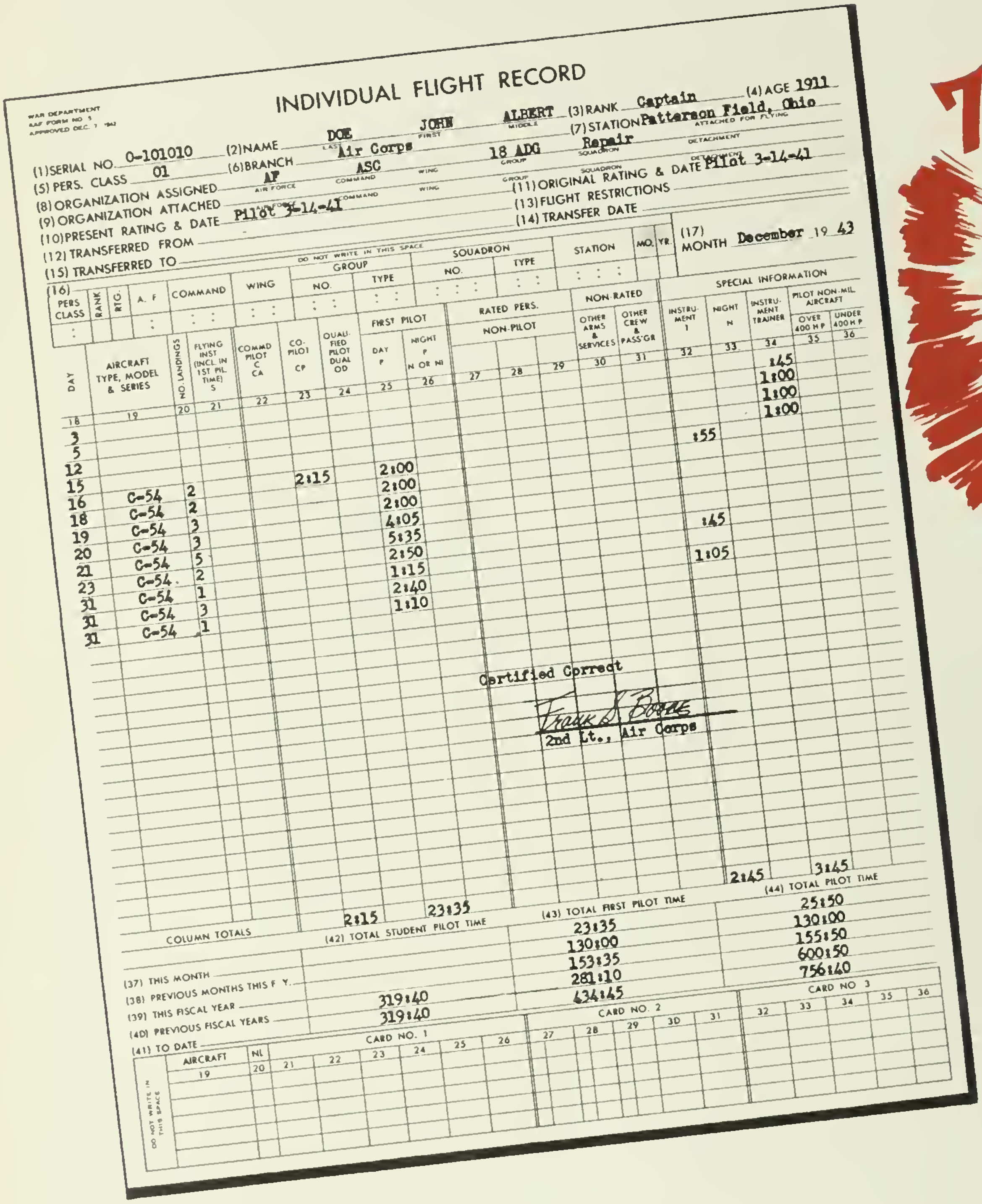
AIRCRAFT AND ENGINE TIME RECORD
(ENTER IN HOURS AND MINUTES)

ENGINE	NO. 1	NO. 2	NO. 3	NO. 4
HOURS TO DATE	143:55	143:55	143:55	143:55
HOURS TODAY	5:00	5:00	5:00	5:00
TOTAL	148:55	148:55	148:55	148:55
OIL CHANGE DUE	H.T.	H.T.	H.T.	H.T.
CUNO. CLEANING DUE	150:00	150:00	150:00	150:00

AIRCRAFT	HOURS TO DATE	143:55
	HOURS TODAY	5:00
	TOTAL	148:55

Form 1A will be executed by the crew chief, and should be in the airplane when you get in it. Check it carefully for the fuel and oil service, and watch for any **red diagonal.** This mark indicates that something is not functioning properly, but that the airplane is flyable.

The Engineering Officer has released the airplane for flight when he signed the Form 41B. If the Engineering Officer has not also signed the exceptional release on Form 1A, the pilot will sign it before he flies the airplane, to indicate that he knows what is not functioning properly.



WAR DEPARTMENT
AAF FORM NO. 5
APPROVED DEC. 1, 1942

INDIVIDUAL FLIGHT RECORD

(1) SERIAL NO. 0-101010
(2) NAME DOE (LAST) JOHN (FIRST) ALBERT (MIDDLE)
(3) RANK Captain
(4) AGE 1911
(5) PERS. CLASS 01
(6) BRANCH Air Corps
(7) STATION Patterson Field, Ohio (ATTACHED FOR FLYING)
(8) ORGANIZATION ASSIGNED AF (AIR FORCE) ASC (COMMAND) (WING) 18 ADG (GROUP) Repair (SQUADRON) (DETACHMENT)
(9) ORGANIZATION ATTACHED (AIR FORCE) (COMMAND) (WING) (GROUP) (SQUADRON) (DETACHMENT)
(10) PRESENT RATING & DATE Pilot 3-14-41
(11) ORIGINAL RATING & DATE Pilot 3-14-41
(12) TRANSFERRED FROM
(13) FLIGHT RESTRICTIONS
(14) TRANSFER DATE
(15) TRANSFERRED TO
(17) MONTH December 19 43

(16) DO NOT WRITE IN THIS SPACE: PERS CLASS | RANK | RTG. | A. F | COMMAND | WING | GROUP NO. | GROUP TYPE | SQUADRON NO. | SQUADRON TYPE | STATION | MO. | YR.

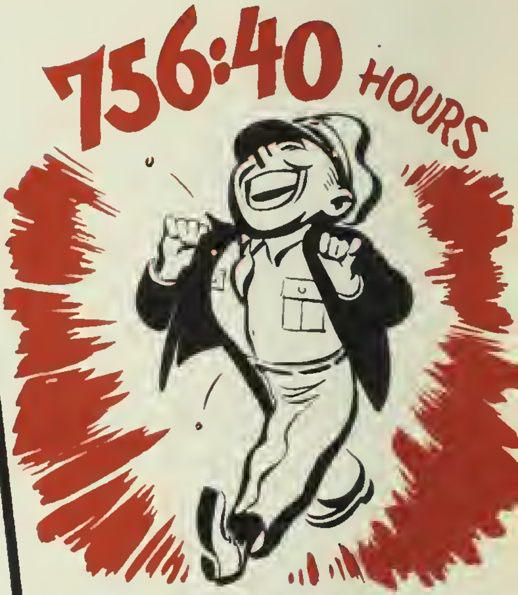
DAY 18	AIRCRAFT TYPE, MODEL & SERIES 19	NO. LANDINGS 20	FLYING INST (INCL. IN 1ST PIL. TIME) S 21	COMMD PILOT C CA 22	CO-PILOT CP 23	QUALIFIED PILOT DUAL OD 24	FIRST PILOT DAY P 25	FIRST PILOT NIGHT P N OR NI 26	RATED PERS. NON-PILOT 27	RATED PERS. NON-PILOT 28	RATED PERS. NON-PILOT 29	NON-RATED OTHER ARMS & SERVICES 30	NON-RATED OTHER CREW & PASS'GR 31	SPECIAL INFORMATION INSTRUMENT I 32	NIGHT N 33	INSTRUMENT TRAINER 34	PILOT NON-MIL AIRCRAFT OVER 400 H P 35	PILOT NON-MIL AIRCRAFT UNDER 400 H P 36
3																:45		
5																1:00		
12																1:00		
15																1:00		
16	C-54	2			2:15		2:00							:55				
18	C-54	2					2:00											
19	C-54	3					2:00											
20	C-54	3					4:05											
21	C-54	5					5:35											
23	C-54	2					2:50							:45				
31	C-54	1					1:15											
31	C-54	3					2:40							1:05				
31	C-54	1					1:10											
COLUMN TOTALS					2:15		23:35							2:45		3:45		

Certified Correct
Frank S. Boone
2nd Lt., Air Corps

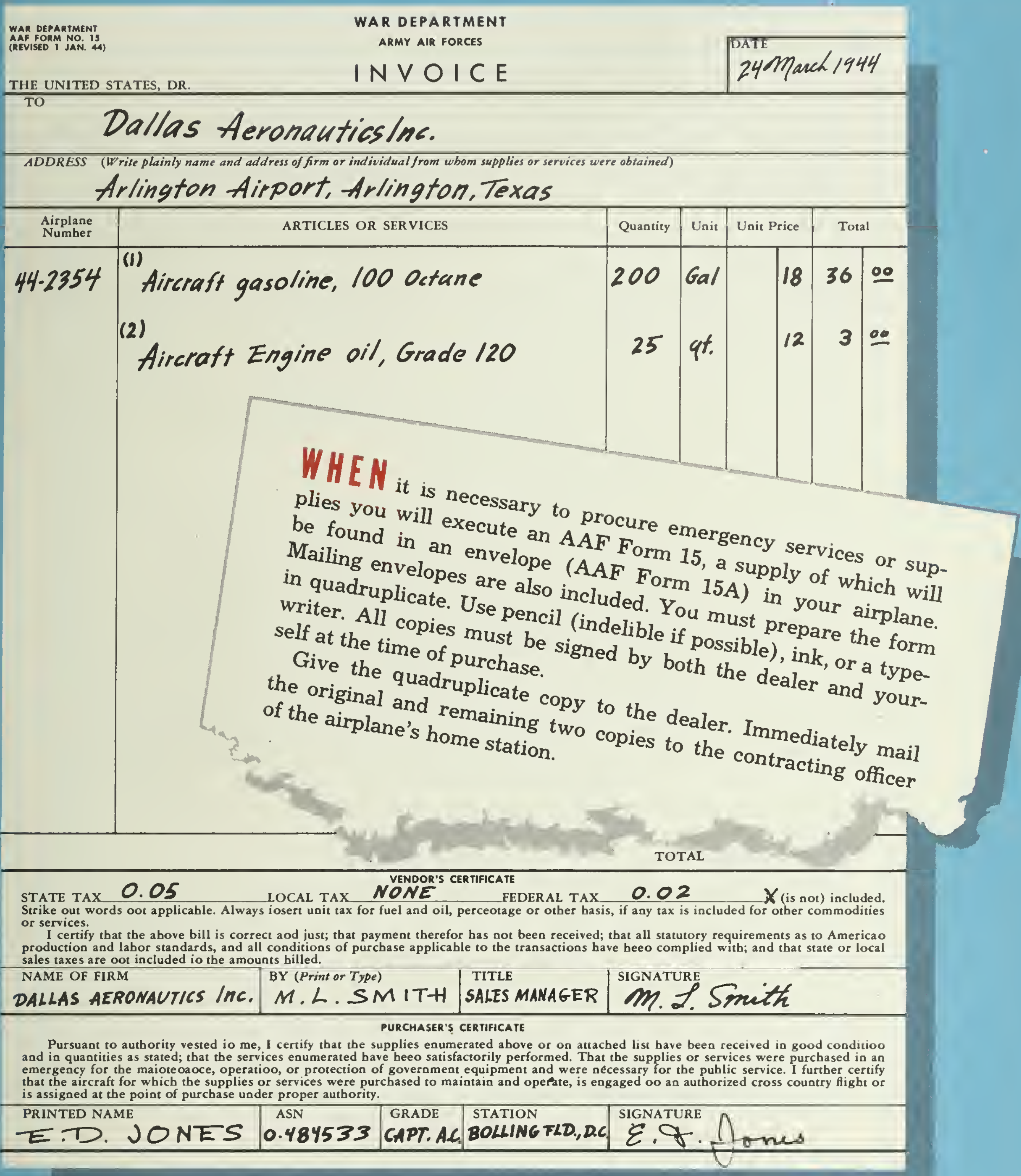
	(42) TOTAL STUDENT PILOT TIME	(43) TOTAL FIRST PILOT TIME	(44) TOTAL PILOT TIME
(37) THIS MONTH		23:35	25:50
(38) PREVIOUS MONTHS THIS F. Y.		130:00	130:00
(39) THIS FISCAL YEAR		153:35	155:50
(40) PREVIOUS FISCAL YEARS	319:40	281:10	600:50
(41) TO DATE	319:40	434:45	756:40

DO NOT WRITE IN THIS SPACE

CARD NO. 1									CARD NO. 2					CARD NO. 3				
AIRCRAFT 19	NL 20	21	22	23	24	25	26		27	28	29	30	31	32	33	34	35	36



Form 5 will be executed for you. Your responsibility is merely to check that you have received proper credit for your flights, and for your time in the Link Trainer.



WAR DEPARTMENT
AAF FORM NO. 15
(REVISED 1 JAN. 44)

WAR DEPARTMENT
ARMY AIR FORCES
INVOICE

DATE 24 March 1944

THE UNITED STATES, DR.
TO Dallas Aeronautics Inc.

ADDRESS (*Write plainly name and address of firm or individual from whom supplies or services were obtained*)
Arlington Airport, Arlington, Texas

Airplane Number	ARTICLES OR SERVICES	Quantity	Unit	Unit Price		Total	
44-2354	(1) Aircraft gasoline, 100 Octane	200	Gal		18	36	00
	(2) Aircraft Engine oil, Grade 120	25	qt.		12	3	00
					TOTAL		

VENDOR'S CERTIFICATE

STATE TAX 0.05 LOCAL TAX NONE FEDERAL TAX 0.02 X (is not) included.
Strike out words not applicable. Always insert unit tax for fuel and oil, percentage or other basis, if any tax is included for other commodities or services.

I certify that the above bill is correct and just; that payment therefor has not been received; that all statutory requirements as to American production and labor standards, and all conditions of purchase applicable to the transactions have been complied with; and that state or local sales taxes are not included in the amounts billed.

NAME OF FIRM	BY (*Print or Type*)	TITLE	SIGNATURE
DALLAS AERONAUTICS Inc.	M. L. SMITH	SALES MANAGER	M. L. Smith

PURCHASER'S CERTIFICATE

Pursuant to authority vested in me, I certify that the supplies enumerated above or on attached list have been received in good condition and in quantities as stated; that the services enumerated have been satisfactorily performed. That the supplies or services were purchased in an emergency for the maintenance, operation, or protection of government equipment and were necessary for the public service. I further certify that the aircraft for which the supplies or services were purchased to maintain and operate, is engaged on an authorized cross country flight or is assigned at the point of purchase under proper authority.

PRINTED NAME	ASN	GRADE	STATION	SIGNATURE
E. D. JONES	0-484533	CAPT. A.C.	BOLLING FLD., D.C.	E. J. Jones

WHEN it is necessary to procure emergency services or supplies you will execute an AAF Form 15, a supply of which will be found in an envelope (AAF Form 15A) in your airplane. Mailing envelopes are also included. You must prepare the form in quadruplicate. Use pencil (indelible if possible), ink, or a typewriter. All copies must be signed by both the dealer and yourself at the time of purchase.

Give the quadruplicate copy to the dealer. Immediately mail the original and remaining two copies to the contracting officer of the airplane's home station.

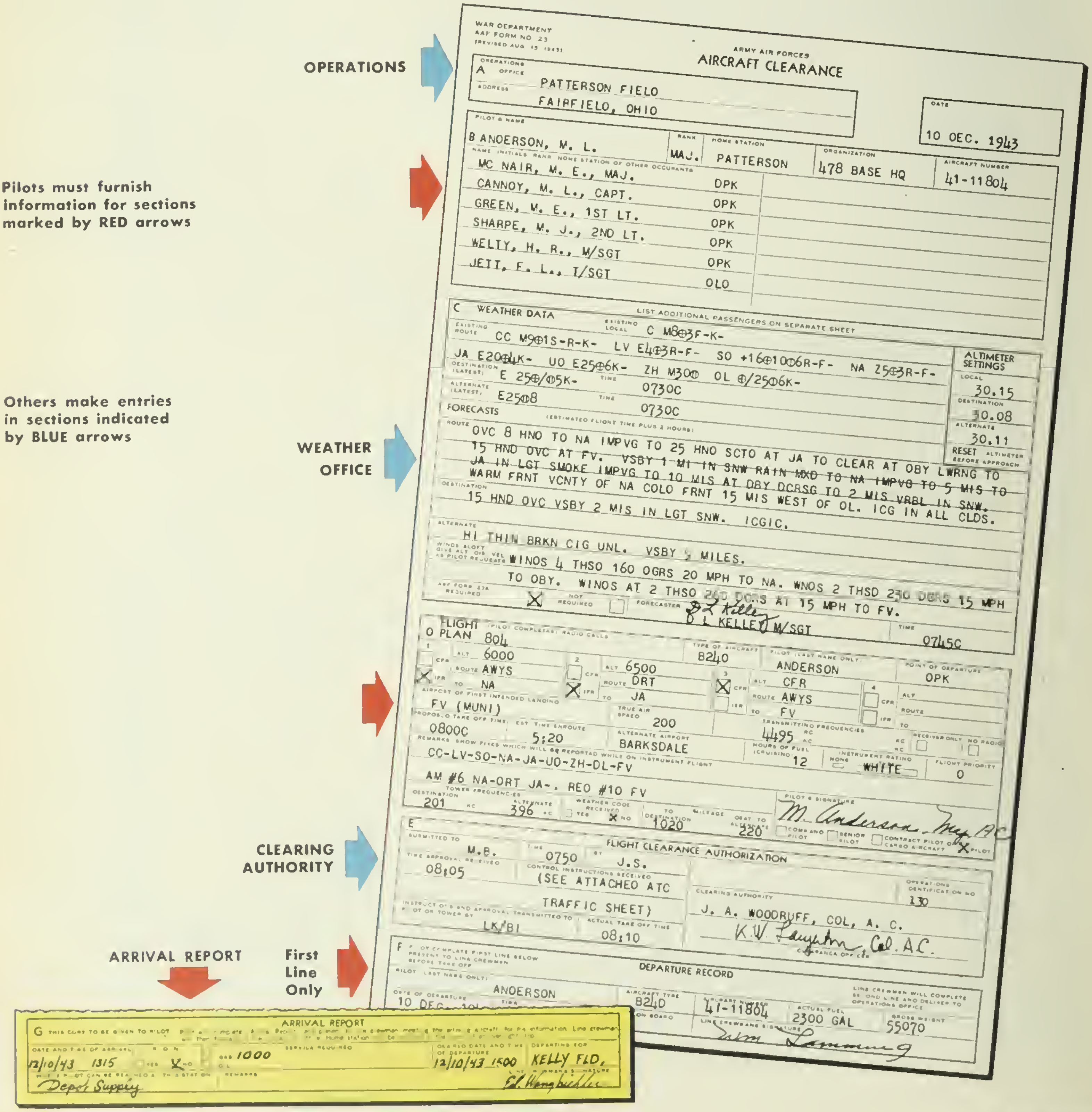
CAUTION: BE SURE TO INCLUDE BOTH THE SERIAL NUMBER OF THE AIRPLANE AND THE NAME OF ITS HOME STATION IN FILLING OUT THE FORM

AAF Form 23 is the clearance form. It is used for all flights except those listed in AAF Reg. 15-23, which may require different forms or be governed by other regulations. For more detailed information on clearances and the use of the Form 23 see PIF 2-2.

You are responsible for information entered in Sections "B" and "D" and the first line of Section "F." Other sections will be filled in by operations, weather office, and Clearing Authority.

The original copy (white) is retained by operations. Section "F" is detached and given to you. After you have filled out the first line give it to the crew chief just before departure. Retain the carbon copy (yellow).

Upon landing complete the "ARRIVAL REPORT" (Section "G") at bottom of the yellow copy and give the form to the crew chief of the alert crew which meets your airplane.



OPERATIONS

Pilots must furnish information for sections marked by RED arrows

Others make entries in sections indicated by BLUE arrows

WEATHER OFFICE

CLEARING AUTHORITY

ARRIVAL REPORT

First Line Only

WAR DEPARTMENT
AAF FORM NO 23
(REVISED AUG 15 1943)

ARMY AIR FORCES
AIRCRAFT CLEARANCE

A OPERATIONS OFFICE
ADDRESS PATTERSON FIELD
FAIRFIELD, OHIO

DATE 10 DEC. 1943

B PILOT'S NAME ANDERSON, M. L.
RANK MAJ.
HOME STATION PATTERSON
ORGANIZATION 478 BASE HQ
AIRCRAFT NUMBER 41-11804

NAME INITIALS RANK HOME STATION OF OTHER OCCUPANTS
MC NAIR, M. E., MAJ. OPK
CANNOY, M. L., CAPT. OPK
GREEN, M. E., 1ST LT. OPK
SHARPE, M. J., 2ND LT. OPK
WELTY, H. R., M/SGT OPK
JETT, F. L., T/SGT OLO

LIST ADDITIONAL PASSENGERS ON SEPARATE SHEET

C WEATHER DATA
EXISTING LOCAL C M8⊕3F-K-
EXISTING ROUTE CC M9⊕1S-R-K- LV E4⊕3R-F- SO +16⊕10⊕6R-F- NA Z5⊕3R-F-
JA E20⊕4K- UO E25⊕6K- ZH M30⊕ OL ⊕/25⊕6K-
DESTINATION (LATEST) E 25⊕/⊕5K- TIME 0730C
ALTERNATE (LATEST) E25⊕8 TIME 0730C

ALTIMETER SETTINGS
LOCAL 30.15
DESTINATION 30.08
ALTERNATE 30.11
RESET ALTIMETER BEFORE APPROACH

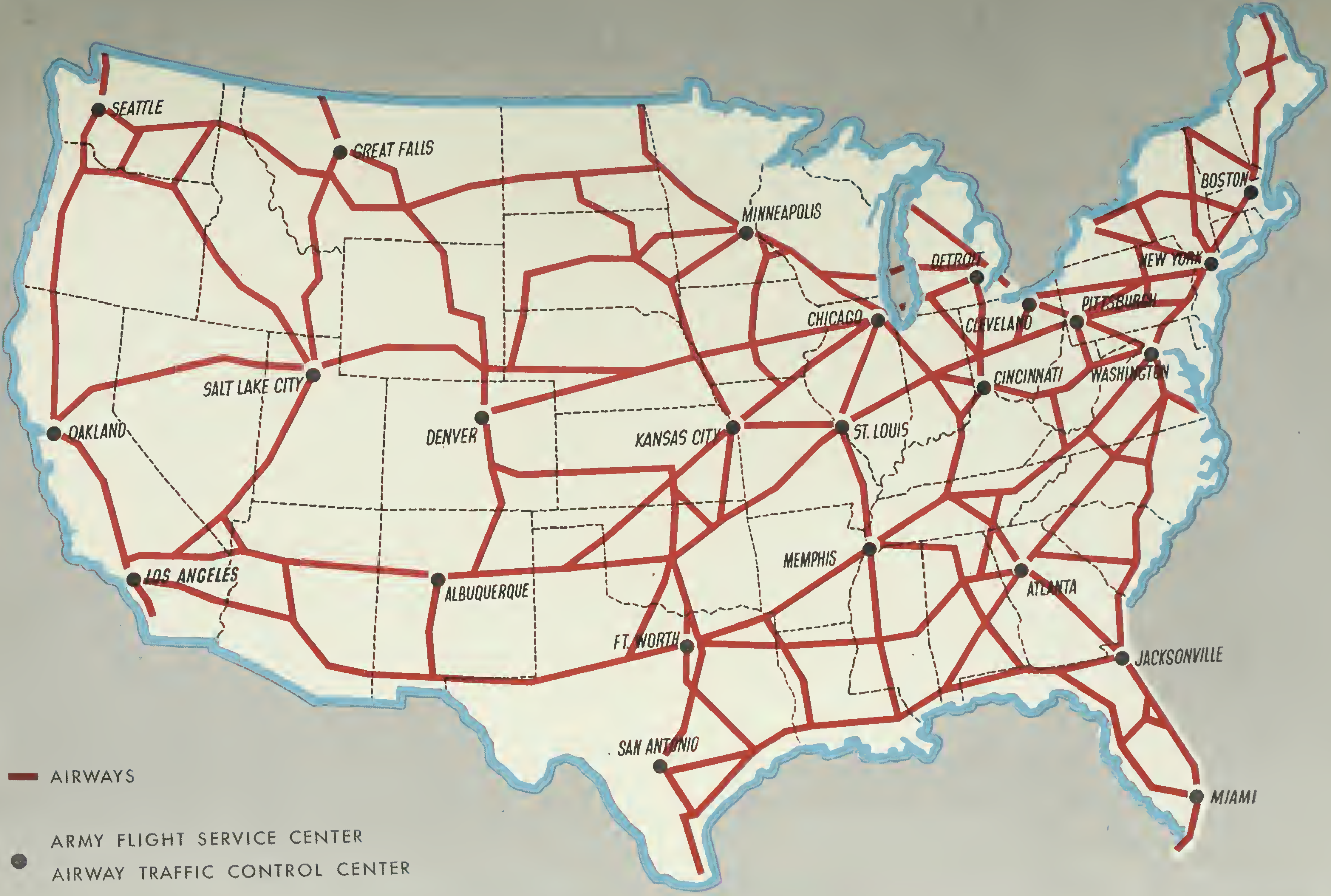
FORECASTS (ESTIMATED FLIGHT TIME PLUS 2 HOURS)
ROUTE OVC 8 HND TO NA IMPVG TO 25 HND SCTD AT JA TO CLEAR AT OBY LWRNG TO 15 HND OVC AT FV. VSBY 1 MI IN SNW RAIN MXD TO NA IMPVG TO 5 MIS TO JA IN LGT SMOKE IMPVG TO 10 MIS AT OBY DCRSG TO 2 MIS VRBL IN SNW. WARM FRNT VCNTY OF NA COLD FRNT 15 MIS WEST OF OL. ICG IN ALL CLDS.
DESTINATION 15 HND OVC VSBY 2 MIS IN LGT SNW. ICGIC.
ALTERNATE HI THIN BRKN CIG UNL. VSBY 5 MILES.
WINDS ALOFT (GIVE ALT DIR VEL AS PILOT REQUESTS) WINDS 4 THSD 160 DGRS 20 MPH TO NA. WNDS 2 THSD 230 DGRS 15 MPH TO OBY. WINDS AT 2 THSD 260 DGRS AT 15 MPH TO FV.
AAF FORM 23A REQUIRED ☒ NOT REQUIRED ☐
FORECASTER D L Kelley
D L KELLEY M/SGT
TIME 0745C

D FLIGHT PLAN (PILOT COMPLETES) RADIO CALLS 804
TYPE OF AIRCRAFT B24D
PILOT (LAST NAME ONLY) ANDERSON
POINT OF DEPARTURE OPK
1 ☐ CFR ☒ IFR ALT 6000 ROUTE AWYS TO NA
2 ☐ CFR ☒ IFR ALT 6500 ROUTE DRT TO JA
3 ☒ CFR ☐ IFR ALT CFR ROUTE AWYS TO FV
4 ☐ CFR ☐ IFR ALT ROUTE TO
AIRPORT OF FIRST INTENDED LANDING FV (MUNI)
TRUE AIR SPEED 200
TRANSMITTING FREQUENCIES 4495 KC
RECEIVER ONLY ☐ NO RADIO ☐
PROPOSED TAKE OFF TIME 0800C
EST TIME ENROUTE 5:20
ALTERNATE AIRPORT BARKSDALE
HOURS OF FUEL (CRUISING) 12
INSTRUMENT RATING NONE ☐ WHITE
FLIGHT PRIORITY 0
REMARKS SHOW FIXES WHICH WILL BE REPORTED WHILE ON INSTRUMENT FLIGHT
CC-LV-SO-NA-JA-UO-ZH-DL-FV
AM #6 NA-DRT JA-. RED #10 FV
TOWER FREQUENCIES DESTINATION 201 KC ALTERNATE 396 KC
WEATHER CODE RECEIVED ☐ YES ☒ NO
MILEAGE TO DESTINATION 1020 DEST TO ALTERNATE 220
PILOT'S SIGNATURE M. Anderson, Maj. AC
☐ COMD AND PILOT ☐ SENIOR PILOT ☐ CONTRACT PILOT OF CARGO AIRCRAFT ☒ PILOT

E FLIGHT CLEARANCE AUTHORIZATION
SUBMITTED TO M.B. TIME 0750 BY J.S.
TIME APPROVAL RECEIVED 08:05
CONTROL INSTRUCTIONS RECEIVED (SEE ATTACHED ATC TRAFFIC SHEET)
INSTRUCTIONS AND APPROVAL TRANSMITTED TO PILOT OR TOWER BY LK/BI
ACTUAL TAKE OFF TIME 08:10
OPERATIONS IDENTIFICATION NO 130
CLEARING AUTHORITY J. A. WOODRUFF, COL, A. C.
K.V. Laughton, Col. A.C.
CLEARANCE OFFICER

F PILOT COMPLETE FIRST LINE BELOW PRESENT TO LINE CREWMAN BEFORE TAKE OFF
DEPARTURE RECORD
PILOT (LAST NAME ONLY) ANDERSON
DATE OF DEPARTURE 10 DEC
AIRCRAFT TYPE B24D
AIRCRAFT NUMBER 41-11804
LINE CREWMAN WILL COMPLETE SECOND LINE AND DELIVER TO OPERATIONS OFFICE
ACTUAL FUEL 2300 GAL
GROSS WEIGHT 55070
LINE CREWMAN'S SIGNATURE Sam Lamming

G ARRIVAL REPORT
DATE AND TIME OF ARRIVAL 12/10/43 1315
☐ YES X NO
GAS 1000
SERVICE REQUIRED
REMARKS
Depot Supply
DATE AND TIME OF DEPARTURE 12/10/43 1500
DEPARTING FOR KELLY FLD.
LINE CREWMAN'S SIGNATURE El. Wengbichler



SECTION 2 FLIGHT

AAF FLIGHT SERVICE

Army Flight Service operates under the Assistant Chief of the Air Staff, Training.

It provides a continuous dispatch, flight, and advisory service to pilots while en route, thereby increasing the number of completed missions with the greatest possible safety.

At present, Flight Service does this through:

1. Clearance of Form 23 Flight Plans at fields where no AAF Operations exist. (PIF 2-2)
2. Approval of all changes in Form 23 Flight Plans made while in flight.
3. Pilots' Advisory Service.

Pilots' Advisory Service

Pilots' Advisory Service is nationwide and available to all Army and Navy pilots on point-to-point flights. Army Flight Service Centers operate in conjunction with CAA Airway Traffic Control Centers.

Your flight plan is transmitted from your point of departure to the Flight Service Center in your area. Trained officers, on duty 24 hours a day:

1. Follow your flight from takeoff to landing.
2. Analyze known weather and traffic conditions: anticipate weather hazards which might affect your flight as you have planned it.
3. Advise you of such hazards and conditions.
4. Answer your specific requests for information or suggestions concerning your flight.

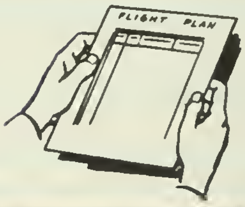
If unforeseen weather, other flight hazards, or field conditions at your destination or alternate develop, Flight Service will advise you. If you're guarding the frequency of the nearest communications station you will hear a series of code dits. Then, "Army Flight Service advises" followed by the message.

IT'S YOUR SERVICE

.....USE IT!

1

FILL OUT FORM 23 CAREFULLY.



2

FOLLOW YOUR FLIGHT PLAN.

3

MAKE POSITION REPORTS FREQUENTLY.

4

KEEP AN ALERT LISTENING WATCH.

5

REQUEST INFORMATION FROM ARMY FLIGHT SERVICE AT FIRST SIGN OF TROUBLE.

Air Traffic Rules

1. **General:**

a. Reckless Operation. An AAF pilot will not operate aircraft in a reckless or careless manner, or so as to endanger friendly aircraft in the air, or friendly aircraft, persons, or property, on the ground.

b. Proximity to Other Aircraft. No aircraft will be flown closer than 500 feet to any other aircraft in flight, except when two or more aircraft are flown in duly authorized formation. On authorized formation flights, aircraft will not be flown closer to each other than the distance of one-half the wingspan of the largest aircraft concerned.

2. **Airspace Reservation.** An AAF pilot will not operate aircraft within any airspace reservation set aside by order of the President of the United States.

3. **Air Traffic Control Procedures.** AAF pilots will comply with air traffic control procedures established by competent authority and Standard Airport Traffic Control Procedures as approved by Army, Navy, and CAA, effective 1 January 1944.

4. **Over-the-top Flight.** No flight of aircraft, unless conducted under instrument flight rules, will be made over broken clouds or stretches of solid overcast, unless the attitude of the aircraft and its flight path can at all times be controlled by visual reference to the ground or water and unless ascent or descent can be made to or from the flight level without approaching closer than 2,000 feet horizontally to the cloud formation.

5. **Right-of-way.** The following rules will govern aircraft right-of-way:

a. Order. Aircraft in flight will have right-of-way in the following order:

Balloons, fixed or free (an airship not under control is classed as a free balloon).

Gliders.

Airships.

Airplanes, including rotorplanes.

b. Crossing. When two aircraft are on crossing courses at approximately the same altitude, the aircraft which has the other on its left will have right-of-way, and the other aircraft will give way.

c. Approaching head-on. When two aircraft are approaching head-on, or approximately so, and there is danger of collision, each will alter its course to the right so that they will pass each other at a distance of at least 500 feet.

d. Overtaking. An overtaken aircraft will have right-of-way and the overtaking aircraft will keep clear of the overtaken aircraft by altering its own course to the right.

e. Landing. Landing aircraft while maintaining a straight approach course for the last 1,000 feet before crossing the airport boundary will have right-of-way over all other aircraft, except aircraft landing in distress.

f. Distress landing. An aircraft in distress shall have right-of-way in attempting to land.

g. Duty to give way. When landing, or maneuvering in preparation to land, it will be the duty of the aircraft at the higher altitude to avoid the aircraft in the lower altitude.

6. **Right side traffic.** Aircraft or formations of aircraft operating along an airway will keep to the right of the radio range course projected along the airway, or if no radio range course is projected along the airway, will keep to the right of the center line of the airway, except:

a. When impracticable for reasons of safety;

b. When otherwise instructed or authorized by an airway traffic control center.

7. **Landing Area Rules:**

a. No aircraft will be taxied until the person in charge has ascertained that there will be no danger of collision with any objects in the immediate area. Aircraft being taxied within 100 feet of the parking area (except in established taxi lanes) or within the parking area will have a man to one wing tip to direct and assist in the taxiing operation. When this is impractical, due to the size or type of aircraft, a man will precede the aircraft at such distance that he is at all times within the view of the person taxiing the aircraft.

Station commanding officers are authorized to establish taxi lanes which will be clearly marked. Taxiing speed and procedures at any station will be as directed by the commanding officer or other competent authority and will be such as to insure reasonable and safe operation. Aircraft operation and movement on the ground will be governed by the provisions of AAF Reg. 62-10.

b. Landings and takeoffs will be made on the runway or landing strip most nearly aligned with the wind or when winds are light in the direction indicated by a controlled T or similar device, if available, unless local or operating conditions make landings and takeoffs in any direction inadvisable or unless exceptions are authorized by an air traffic control tower operator.

c. No takeoffs will be commenced until the pilot has ascertained that there is no danger of collision with any object in the takeoff path.

d. No turn will be made after takeoff until the airport boundary has been reached and the pilot has attained an altitude of at least 500 feet and has ascertained that there will be no danger in turning into the path of a following aircraft, unless exceptions are authorized by an air traffic control operator.

e. During and after a takeoff or when approaching, the pilot of an aircraft equipped with a functioning radio receiver will guard the air traffic control tower frequency until the air traffic control operator signs off.

8. **Flight in range approach channel, unless on an approved flight plan:**

a. Flight in a range approach channel will be below 1,500 feet except to enter the channel on the right side as determined by the direction of flight along such channel, and then continue along the channel in normal cruising flight.

b. Flight below 1,500 feet within the range approach channel will be confined to crossing the channel at an angle of not less than 45°, and to those maneuvers incidental to takeoffs and landings.

9. **Aircraft departing from or arriving at a controlled airport.**

Aircraft departing from or arriving at a controlled airport will take precedence over other air traffic within the control zone of such airport.

10. **Acrobatic flight.** No pilot will perform acrobatics:

a. At any height whatsoever over a congested area of any city, town, or settlement, or over any open-air assembly of persons.

b. Within the area included within the radius of five miles of the center of any airport except when such airport is within an established local flying area; or within the limits of a civil airway except within that portion lying adjacent to, but outside of, a range approach channel.

c. At any place other than unrestricted areas.

d. Unless the maneuvers can be completed and the aircraft under complete control at or above 1,500 feet (altitude above the surrounding terrain).

e. At any place, unless the visibility is at least 3 miles and the ceiling at least 3,000 feet, and unless the pilot has first ascertained that there is no danger of collision with other aircraft.

11. **Light and signal rules.** Between sunset and sunrise all aircraft in flight, or stationary, and likely to cause a traffic hazard, will show the regulation position lights.

12. **Fog signals.** Unless military necessity requires otherwise, an aircraft on the water in navigation lanes in fog, mist, or heavy weather will signal its presence by a sound device emitting a signal for about five seconds at one-minute intervals.

13. **Distress signals.** The following signals, separately or together, will, where practicable, be used in case of distress. **a.** The international signal, SOS by radio: In radio-telephony, the spoken expression MAYDAY (corresponding to the French pronunciation of the expression "m'aider"). When, owing to the rapidity of the maneuvers to be accomplished,

an aircraft is unable to transmit the intended message, the signal PAN not followed by a message retains such meaning. **b.** The international code flag signal of distress, NC. **c.** A square flag having a ball, or anything resembling a ball, above or below it.

14. **Aircraft on water.** Seaplanes on the water will navigate according to the laws and regulations of the United States governing the navigation and operation of watercraft, except as otherwise specifically authorized.

Contact FLIGHT RULES

15. **Aircraft approaching and circling:**

a. Aircraft approaching and circling for a landing or making contact flight below 1,500 feet above the ground or water within three (3) miles horizontally of the center of an airport or landing area will circle the airport or other landing area sufficiently to observe other traffic, unless the pilot receives other instructions from the air traffic control operator. All circles, whether approaching for a landing or after takeoff, will be made to the left, unless the pilot receives other instructions from the air traffic control operator, or unless in the interest of safety a different procedure has been prescribed for the particular airport or landing area.

b. Aircraft approaching for a landing will, unless impracticable, or unless exceptions are authorized by an air traffic control operator, maintain a straight approach course for the last 1,000 feet before crossing the airport boundary.

16. **Minimum altitudes of flight:**

a. Except during takeoff and landing, aircraft will not be operated:

(1) Below the following altitudes:

(a) 1,000 feet above any building, house, boat, vehicle, or other obstructions to flight.

(b) At an altitude above the congested sections of cities, towns, or settlements to permit an emergency landing outside of such sections in the event of complete power failure.

(c) 1,000 feet above any open-air assembly of persons.

(d) 500 feet above the ground elsewhere than as specified above.

(2) Within 500 feet of any obstruction to flight.

b. Any maneuver may be conducted at such altitude above the ground or water as is necessary for its proper execution in places other than specified above, when such maneuver is required to accomplish an ordered tactical flight, engineering, or training mission.

17. **Contact flight.** Pilots of military aircraft flying under contact conditions, except when engaged (1) in practicing takeoffs and landings under contact flight rules at an altitude of not more than 1,500 feet above the airport from which such practice is conducted, or (2) in flight in established local flying areas, will:

a. File a flight plan as defined in paragraph 41 with an airway traffic control center. In case of a formation flight, only one flight plan need be filed, which plan will indicate the number of aircraft making the flight.

b. Except for necessary ascent and descent, maintain flight altitudes on civil airways as nearly as existing conditions permit, as follows:

Eastbound flights on green and red civil airways and northbound flights on amber and blue civil airways will be conducted at the odd 1,000 foot levels (such as 5,000, 7,000, and 9,000 feet). Westbound flights on green and red civil airways and southbound flights on amber and blue civil airways shall be conducted at the even 1,000 foot levels (such as 4,000, 6,000, and 8,000 feet).

Do not cross a civil airway at an angle of less than 45° unless otherwise instructed.

18. **Proximity to cloud formation.** Aircraft will not be flown closer than 500 feet vertically to an overcast or cloud formation nor closer than 2,000 feet horizontally to a cloud formation.

19. **Weather minimums.** The following weather minimums will govern flights made in accordance

with contact flight rules, provided that, in the interest of safety, an airway traffic control center may restrict or suspend contact flight operation within the airway traffic control area of such center:

a. **Within control zones.** Aircraft will not be flown within a control zone (or within 3 miles horizontally of the center of a military airdrome) unless the ceiling is at least 1,000 feet and the visibility is at least 3 miles: **Provided**, that an airport traffic control-tower operator on duty in an airport control tower may authorize flight at altitudes of 1,000 feet or less above the ground or water when the visibility is less than 3 miles but not less than 1 mile.

b. **Outside control zones.** Aircraft will not be flown at or below 1,000 feet above the ground or water unless the visibility during the hours of daylight is at least 1 mile and during the hours of darkness is at least 2 miles and will not be flown above 1,000 feet above the ground or water, unless the visibility (forward) is at least 3 miles at flight altitude.

c. **Ferry Flights of Military Necessity.** Notwithstanding any of the foregoing provisions of this section, AAF aircraft making ferry flights, in case of military necessity, may, in compliance with all other contact flight rules:

(1) Take off from, or fly over airports where the local visibility conditions are below the minimum hereinbefore established for operations under such flight rules, provided the visibility elsewhere along the civil airways to be flown is equal to or above such minimum.

(2) Be cleared to fly above an overcast in the clear, provided: (a) The pilot holds a currently effective instrument rating. (b) The aircraft is equipped with a radio receiver capable of tuning through the 200 to 400 kilocycle range. (c) Flight on top of the overcast does not exceed one hour. (d) Visibility at flight altitude is at least two miles. (e) The ceilings at the points of departure and destination are unlimited, and the weather forecasts indicate that the ceiling at the point of destination will remain unlimited until the arrival of the flight thereat.

d. Requests for authority to deviate from minimums specified in a and b above when deemed necessary because of peculiar local conditions, will be submitted to the Commanding General, AAF, Attention: Chief of Flying Safety.

20. **Weather changes.** If weather conditions below the minimum prescribed in paragraph 19 are encountered en route, a landing will be made at the nearest airport at which weather conditions are equal to or better than those prescribed in paragraph 19, or the flight may be altered so that it may be made in weather conditions as good as, or better than, such minimums, unless such flight can and does proceed in accordance with the instrument flight rules prescribed in "INSTRUMENT FLIGHT RULES."

Instrument FLIGHT RULES

21. **Pilot.** A pilot may, and will be encouraged to, engage in instrument flight provided he holds currently effective Instrument Pilot Certificate AAF Form 8 (white) or AAF Form 8A (green). Currently effective Certificates of Competency, signifying qualification to engage in flight under instrument conditions, issued by the Royal Air Force Transport Command, or the Royal Canadian Air Force, and held by pilots of such air forces, will be considered as equivalent to Instrument Pilot Certificate AAF Form 8 (white). (As to pilots of the Royal Canadian Air Force, see paragraph 8, AAF Regulation 61-2B.)

22. **Weather Minimums.** The following weather minimums will govern:

a. For holders of Instrument Pilot Certificate, AAF Form 8A (green):

No takeoff will be made when the ceiling is less than 200 feet or the visibility is less than one-half mile, except that Commanding Officers of OTU, RTU, Tactical and Training Units, may authorize takeoffs at minimums less than 200 feet and one-half mile visibility, provided such takeoffs are under the direct supervision of competent and duly authorized instructors of the training organization. (Training under these conditions is considered necessary because tactical pilots will be required to take off under actual weather conditions of less than 200 feet and one-half mile visibility during combat missions.)

No landing weather minimums are applicable to pilots who hold a currently effective Instrument Pilot Certificate, AAF Form 8A (green), and clearance will depend upon the judgment and be the responsibility of such pilot.

b. For holders of Instrument Pilot Certificate, AAF Form 8 (white):

(1) No takeoff will be made when ceiling is less than 500 feet or visibility is less than one mile.

(2) No clearance will be issued for a flight to a destination at which ceilings or visibilities are reported to be less than those established by standard Instrument Approach Procedures, TO 08-15-3, for the particular station cleared for and forecast to remain steady or improving until the expected arrival thereat, and in no circumstances will any clearance be authorized for flight to a destination where visibility is reported or forecast as being less than one mile. In case no weather minimums for the particular station to be cleared for are published in TO 08-15-3, the following minimums will apply:

DAY		NIGHT	
Ceiling	**Visibility**	**Ceiling**	**Visibility**
800	1	1000	2
700	1½	800	3
600	2		
500	3		

c. In the case of Army contract air transportation service, weather minimums will be those set forth in the air carrier's operations manual and approved by the Air Transport Command. At stations where weather minimums have not been previously submitted by the air carrier and approved by the Air Transport Command, the minimums will be those specified in subparagraph **b**, above.

23. **Flight rules.** In addition to general flight rules or any special air traffic rules which apply, instrument flight rules will govern the following:

a. Flight in closer proximity to cloud formation than 500 feet vertically to an overcast or cloud formation, or closer than 2,000 feet horizontally to a cloud formation.

b. Flight in weather conditions worse than those described in paragraph 22.

24. **Aircraft Clearances and Flight Plan.** Aircraft clearances and flight plans will be governed by AAF Reg. 15-23.

25. **Alternate airport.** No takeoff of aircraft will be made unless:

a. The alternate airport named in the flight plan has a landing area suitable for the aircraft to be used, and

b. Weather reports and forecasts indicate that the weather conditions at the alternate airport will remain at or above the minimum specified in **c** or **d** of this paragraph, until the arrival of the aircraft thereat.

c. The alternate airport is equipped with a radio directional aid to air navigation in operation and there is at such alternate airport a ceiling of at least 2,000 feet and a visibility of at least three miles if an overcast exists; or a ceiling of at least 1,500 feet and a visibility of at least three miles if broken clouds exist; or

d. If the alternate airport is not equipped with a radio directional aid to air navigation, there is at such alternate airport an unlimited ceiling and a visibility of at least three miles.

e. In the case of Army contract air transportation service, weather minimums for alternate airports will be those set forth in the air carrier's operations manual and approved by the Air Transport Command. At stations where weather minimums have not been previously submitted by the air carrier and approved by the Air Transport Command, the minimums will be those specified in subparagraphs **c** and **d**, above.

f. The aircraft is provided with fuel and oil sufficient, considering the wind and other weather conditions forecast for the flight:

(1) To complete such flight to the point of the first intended landing, and thereafter.

(2) To fly to and land at the alternate airport designated in the approved flight plan, and thereafter.

(3) To fly, at normal cruising consumption, for a period of 45 minutes.

26. **Communication contacts.** The pilot will maintain a continuous listening watch on the appropriate radio frequency and will contact and report as soon as possible to the appropriate communications station the time and altitude of passing each radio fix or other check point established within the civil airways or specified in the flight plan.

27. **Communications failure.** In the event of failure of aircraft two-way communication equipment or in the event that the pilot does not receive radio signals sufficient to permit him to maintain instrument navigation, one of the following procedures

will be observed:

a. Proceed in accordance with contact rules.

b. Effect a landing at the nearest suitable airport at which favorable weather conditions exist.

c. When sufficient radio signals are received, proceed according to flight plan, including any amending instructions issued and acknowledged en route.

28. **Crossing an airway.** Unless otherwise instructed, a civil airway will not be crossed at an angle of less than 45° to such airway.

29. **Flight altitude.** Exclusive of taking off from or landing upon an airport or other landing area, aircraft making an instrument flight will not be flown below 1,000 feet above the ground or water nor within 1,000 feet of a mountain, hill, or other obstruction.

30. **Let-down procedures.** Descent through an overcast to contact flight condition at other than a range station for which a let-down procedure has been established, will not be attempted unless the pilot can specifically identify his position by means of navigational aids and has definite knowledge of the terrain.

Definitions

31. **Airport control tower.** An airport control tower is an establishment equipped to allow the operator thereof to control air traffic in the immediate vicinity of an airport.

32. **Airway traffic control area.** An airway traffic control area is an area within the limits of an airway designated by the Administrator of Civil Aeronautics, or by competent military authority, over which an airway traffic control center exercises control.

33. **Airway traffic control center.** An airway traffic control center is a station operated by the Administrator of Civil Aeronautics, or by the military forces, for the purpose of controlling air traffic on established airways.

34. **Airway communications station.** An airway communications station is an airway radio, teletype, or other communications station operated by the Administrator of Civil Aeronautics, or by the military forces.

35. **Alternate airport.** An alternate airport is an airport, other than the point of first intended landing, specified in the flight plan, and to which the flight may proceed in case of emergency.

36. **Ceiling unlimited.** A ceiling is considered unlimited when clouds cover less than one-half of the sky or when the base of the clouds is more than 9,750 feet above the point of observation.

37. **Control airport.** A control airport is an airport where, in the interest of safety, air traffic is controlled from the ground by means of radio communication or visual signals.

38. **Contact flight.** Contact flight is flight conducted in such a manner that ground and water within gliding distance of the aircraft can at all times be used for visual reference.

39. **Control zone.** A control zone is the airspace above that area on the surface of the earth within 3 miles horizontally of the center of an airport designated by the Administrator of Civil Aeronautics as a control airport, and within one-half mile of a line extending from the center of such airport to the radio range station established for the purpose of directing air traffic to such airport.

40. **Cruising altitude.** Cruising altitude is a flight altitude, measured in feet above sea level, proposed for that part of a flight from point to point during which a constant altitude will be maintained.

41. **Flight plan.** A plan of flight filed with an Army Airway Control Center, or the Administrator of Civil Aeronautics, in such manner and containing such information as may be required by Section D of AAF Form 23.

42. **Instrument flight.** That portion of any flight which cannot be made by visual reference to ground or water within gliding distance of the aircraft, or which approaches closer than 500 feet vertically to the base of an overcast, or 2,000 feet horizontally to a cloud formation.

43. **Radio fix.** A radio fix is a geographical location on an airway above which the position of an aircraft in flight can be accurately determined by

means of radio only, such as: a cone of silence marker, Z type marker, fan type marker, or intersection of radio range "on course" signals.

44. **Radio range station.** A radio range station is a radio station from which radio signals are emitted for the purpose of assisting an aircraft to maintain a course.

45. **Range approach channel.** A range approach channel is the airspace above the ground or water below 17,000 feet above sea level located within 2 miles of either side of the center of the "on course" signal of any designated leg or legs of a radio range station serving a control airport, and extending along such leg or legs from such radio range station for a distance of 15 miles.

46. **Visibility.** Visibility is the greatest mean horizontal distance toward at least 50 per cent of the horizon at which conspicuous objects can be readily identified by the naked eye.

47. **Zone of intersection.** A zone of intersection is that part of a civil airway which overlaps and lies within any part of any other civil airway.

48. **Parking area.** Those portions of airport aprons, ramps, lines, or other spaces, so designated by the commanding officer and reserved for the open-air parking of friendly aircraft.

NONAPPLICATION OF AIR TRAFFIC RULES

49. These air traffic rules will not apply in the following cases:

a. When special circumstances render nonobservance necessary to avoid immediate danger, or when such nonobservance is required because of stress of weather conditions which could not reasonably have been foreseen, or for other unavoidable causes. Such nonobservance, including the emergency making the nonobservance necessary, the results accomplished by such nonobservance, and when regular observance was resumed after the emergency had passed, will be reported in writing in full detail within 24 hours to the operations officer at the point of first landing after such nonobservance, which report will be transmitted by the operations officer without delay to the commanding officer of the pilot's home station. The commanding officer's remarks will be placed upon such reports, and the report forwarded to the Commanding General, AAF, Attention: Chief of Flying Safety.

b. When military necessity requires. If the military necessity is such as to endanger other aircraft operating on airways, the appropriate airway traffic control center will be notified.

c. When in the interests of safety. C.O.'s are authorized to prescribe more stringent regulations for any airport under their control.

d. When Necessary to Carry out Training Directives. Aerial reviews and parade flight formations, unless in the form of a tactical combat maneuver or demonstration, will not be deemed as necessary to carry out training directives, and will not be authorized. The provisions of this sub-paragraph will not be invoked to authorize deviations from the provisions of paragraphs 1 and 2 above. When deviation from the provisions of these regulations is deemed necessary for flying training activities, commanding officers will be responsible for: (1) the coordination of such training with all other activities concerned in the local area involved, (2) the notification of the appropriate airway traffic control center and (3) an entry, "Authorized Deviations" being made in the Remarks column of Section D, "Flight Plan", on the AAF Form 23 for the flight.

REFERENCE: AAF Regs. 60-16, 6 March 1944; 60-16A, 15 April 1944; 60-16B, 1 May 1944; 60-16C, 16 May 1944.

CLEARANCE FOR AIRCRAFT

Procedures governing the clearance of aircraft are contained in AAF Reg. 15-23, along with directions for filling out your individual clearance, the AAF Form 23. A sample of this form is shown in PIF 1-13-6.

Contact Flight Rules (CFR) and Instrument Flight Rules (IFR) published in AAF Reg. 60-16 (See PIF 2-1) and rules published in AAF Reg. 15-23 will govern all aircraft clearances.

All pilots will use Form 23 for clearance on all flights except those specifically exempted by AAF Reg. 15-23.

Weather Data and Flight Plan

Step by step procedure in filling out Form 23 is shown in the accompanying illustrations.

If there is no qualified weather personnel on duty, check the available weather information, insert a statement in Section C that you have done so, and initial same.

If you are a pilot with clearing authority, you may either present your Form 23 to the weather office in the usual manner, or simply initial Section C, signifying that you have current weather information.

After completion of Section C complete Section D by indicating whether your flight will be CFR or IFR.

If your flight is to be on instruments you must pick

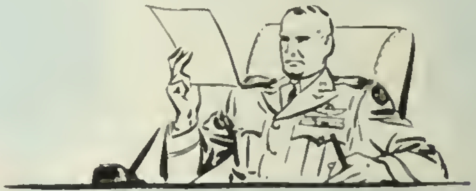
THE STORY OF THE FORM 23

OPERATIONS MAKES FIRST ENTRIES IN SECTION A OF YOUR FORM 23

YOU MAKE ENTRIES IN SECTION B AND FILL IN "AIRPORT OF FIRST INTENDED LANDING" IN SECTION D

WEATHER OFFICE MAKES ENTRIES IN SECTION C, "WEATHER DATA"

YOU THEN COMPLETE SECTION D, "FLIGHT PLAN"



CLEARING AUTHORITY SIGNS FORM

an alternate airport at which weather conditions meet alternate airport weather requirements. You must also have enough fuel to (1) fly to airport of first intended landing, then (2) proceed to alternate airport if first airport is closed, and (3) remain aloft over alternate for at least 45 minutes.

Clearance

Clearances will normally be valid for one hour from proposed takeoff time unless cancelled by competent authority.

Command Pilots, who for purposes of clearance will be considered to possess a green Instrument Pilot Certificate (AAF Form 8A) are authorized to:

1. Act as their own clearance authorities for IFR or CFR flights.
2. Clear individuals for CFR flights which they accompany or which are under their control.

Senior Pilots, Senior Service Pilots, and Civilian Contract Pilots of Air Transport Command may act as their own clearance authorities, or may clear individuals on flights they accompany, or which are under their direct control, for CFR flights. These three classes of pilots may, if they hold valid white Instrument Pilot Certificate (AAF Form 8), clear only themselves for IFR flights.

Pilots holding valid green cards may clear themselves on CFR or IFR flights.

In all other cases pilots can be cleared only by the authorized clearing authority.

You cannot be cleared for instrument flight if you don't hold a valid white certificate.

Even if you hold a white certificate, but it shows total pilot time less than 500 hours, you cannot be cleared for instrument flight if ceiling or visibility is at or near instrument flight minimums.

No matter what your rating nor the extent of your clearing authority, don't taxi nor take off until authorized by the tower.

No AAF Operations

Before departing from a location where there is no AAF operations office you must file a flight plan with an AAF Flight Control Center, using any Army approved communications facility. Army Flight Control Centers are located at all CAA Airway Traffic Control Centers. Unless you are your own clearance authority, you must wait for Army Flight Control's approval before taking off. **All pilots are urged, however, to wait for any further information from Army Flight Control.**

If approved communications facilities are not available, you may take off under CFR flight conditions only, and fly to the nearest practicable point where they are available. You may then request a change of flight plan in flight, or land and file a flight plan in the usual manner.

Formation Flights

If you are the Flight Commander of a formation flight, make out a Form 23 for your own airplane. Put the words "Flight Commander" after your signature, and on the form or an attached list enter: model and serial number of each plane in the formation; name, rank, serial number of each crew member in the flight; name, rank of other occupants. Then brief pilots and see that they have proper maps and instrument ratings. Certify to this action under "Remarks."

FILL IN SECTION F, "DEPARTURE RECORD," HAND IT TO LINE CREWMAN. HOLD DUPLICATE YELLOW FORM, "ARRIVAL REPORT."

DON'T TAKE OFF UNTIL TOWER GIVES YOU FINAL GO-AHEAD

AFTER ARRIVAL FILL IN G (YELLOW FORM), "ARRIVAL REPORT," HAND TO CREWMAN

RADIO CHANGE IN FLIGHT PLAN

Any deviation from the original flight plan you have filed on your Form 23 requires a new clearance by radio. Note: Changing your altitude or route under CFR conditions is not considered a deviation.

Unless you are a pilot with clearing authority, here is what you must do:

Request approval for your intended change **before you make it**, using the nearest available radio facility (consult radio facility charts).

Report (1) your position, (2) details of the change you wish to make, (3) remaining hours and minutes of fuel aboard, and (4) estimated time en route from current position to destination.

The reply you get, after your request has been processed and approved by the proper agencies, will begin with either the words "Army Flight Control approves - -" or "Airway Traffic Control approves - -". This is all you need to remember, as the approval you receive is final unless specifically stated otherwise.

If you are a pilot with clearing authority and flying under CFR conditions, you can make the change without approval. However, you must report your change and give same information as outlined above. **All pilots, regardless of their rating, will make no change in flight plan when flying under IFR conditions without first obtaining approval.**

In case of an emergency, you will use your own good judgment and take whatever action is necessary. You are required by regulation, however, to report such action as soon as possible through the nearest available radio communications facility.

How Approval Is Granted

The following information, although you need not remember it in flight nor let it confuse you in any way, is given so that you can better understand how radio requests for changes in flight plan are handled.

A pilot in flight is subject to two types of clearances by radio. One is concerned with **traffic separation** on the airways and is always subject to the approval of CAA Airway Traffic Control Centers. The other is in the nature of a **dispatch clearance** and is granted (or refused) by Army Flight Control.

These two agencies are always located in the same office and coordinate closely. Your request through your nearest available radio facility is relayed by interphone to an Airway Traffic Control Center where the two agencies process it. Airway Traffic Control is concerned only with change of flight plan on the airways under IFR conditions. However, Army Flight Control is concerned with all changes of flight plan, on or off the airways, under CFR or IFR conditions. The approval involved is something that will be determined for you automatically on the ground, depending on the nature of your intended change. Thus when you hear either "Army Flight Control approves - -" or "Airway Traffic Control approves - -" you need not worry whether or not the proper agency has received your request.

PASSENGERS *in aircraft*

Number of Passengers

The number of persons carried in Army aircraft will not exceed that for which the aircraft is designed, except when necessary in cases of emergency:

1. Involving great physical hardship or possible loss of life.
2. In the performance of urgent military duties.

In the absence of specific instructions from higher authority, the character of the emergency will be determined by the commanding officer of the Army Air Forces station where the flight originates, except when the emergency arises elsewhere than at such a station, in which case its character will be determined by the senior Army Air Forces officer on duty with the flight.

Travel by Army Aircraft

Passenger space on routine interstation flights of Army aircraft may be utilized for authorized travel of members of the Army of the United States on official duty for the purpose of reducing the expense to the Government of the travel involved or to save time.

Under no consideration will this type of travel impose an added burden in the way of additional flights or the alteration of previously planned flying schedules.

Any exception to these regulations will be made only after a presentation of the case and action thereon by the Commanding General, Army Air Forces.

Commanding officers of AAF stations are authorized to grant exceptions in case of civilians who are to be flight-tested for a military aeronautical pilot rating under the provisions of AAF Reg. 50-7. No release is required.

On Leave or Furlough

Military, Naval, Marine Corps, and Coast Guard personnel, while on leave of absence, furlough, or on detached service, may be permitted by commanding officers of AAF stations or higher authority to ride as passengers on flights in Army aircraft when such flights are incident to a regularly scheduled mission, and **provided such transportation does not involve additional expense to the Government.**

Passengers on ATC Aircraft

AAF Reg. 75-3 establishes special regulations for the transportation of passengers on aircraft operated by the Air Transport Command. All aircraft of the Air Transport Command engaged in air transport operations, whether flown by civilian crews under contract or by military crews, are military aircraft and as such are authorized to transport only those passengers who are in possession of military orders expressly authorizing or directing travel by military aircraft or those whose travel will facilitate the prosecution of war activities.

Passengers will be carried on such aircraft only when priority for transportation has been established by the Commanding General, ATC, Washington, D. C., or his authorized representative.

Releases will be required from such passengers as would be required to sign releases in case of travel in other military aircraft.

No Release Required

Commanding officers of AAF stations or higher authority in the chain of command are authorized to permit the persons listed below to ride as passengers in Army aircraft under their control under proper orders and clearance **without signing a release.**

1. Military personnel of the Army, Navy, Marine Corps, Coast Guard, Women's Army Corps, and commissioned officers of the U. S. Coast and Geodetic Survey.
2. Civilian employees of the War Department, of other Government agencies, of Government contractors, and technical advisors to military authorities engaged in activities for the Army which require such flight.
3. Students, foreign or otherwise, undergoing instruction with or under supervision of the AAF, when such flights are a part of the authorized course of instruction.
4. Red Cross personnel when serving with the armed forces of the United States in the field either at home or abroad.
5. Subject to the approval of the Commanding General, AAF, members of the Cabinet and certain other officials of the Government, members of Congress, and governmental employees.

Release Required

Commanding officers of AAF stations or higher authority in the chain of command are authorized to permit the persons listed below to ride in Army aircraft under their control, **only, in the case of civilians, upon signing the injury or death release.**

1. Military and civilian personnel of foreign nations in cases involving war activities, including projects carried out under the Lend-Lease Act.
2. On flights which will not extend beyond the local flying area: wives, mothers, and children of military personnel of the U. S. who hold aeronautical ratings and who are required in the performance of their duties to participate in regular and frequent flights. Such children must be ten years of age or over and have the permission of a parent. These flights must not exceed two in number for any person during any calendar year.
3. Subject to the approval of the Commanding General, AAF, representatives of the pictorial and news disseminating agencies on flights which will benefit the War Department. Such flights may be conducted within the continental limits of the U. S. and its territorial possessions.
4. The commanding general of any theater, or any department, base command, defense command, or task force, **outside the continental limits of the United States** may authorize any person to ride as passenger in Army aircraft under his control when this action is necessary or desirable in the Government interest.
5. AAF members of the U. S. Military missions in Latin America are authorized to carry as passengers, on local flights, within the jurisdiction of the mission, distinguished nationals of the country in which they are stationed, on the approval of the U. S. ambassador or minister. At the discretion of the chief of the mission, members of the armed forces of the country in which they are stationed and students who are under their instruction may be carried as passengers only after signing a release.

Release Required, When Practicable

Commanding Officers of AAF stations or higher authority in the chain of command may permit any person to ride as passenger in Army aircraft, in case of emergency involving catastrophe or possible loss of life, when other means of transportation is not available. **Civilians will be required to execute releases, when practicable.**

REFERENCE: Army Reg. 95-90, AAF Reg. 50-7, AAF Reg. 60-20, AAF Reg. 75-3.

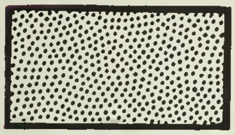
IMPORTANT

Whenever you clear from a station or airport where there are no AAF facilities, you are required to leave with the local operations officer, airport manager, or other suitable person a list of all passengers, showing name and home station of each.

AIR SPACE RESERVATIONS AND FLIGHT HAZARDS

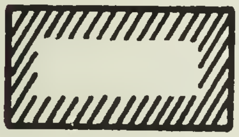
Before making a flight, study the map in the Operations Office and ascertain whether your projected flight plan will bring you close to any areas shaded or marked as shown below. If it does, consult the **Weekly Notice To Airmen** and current **Notams** for specific details and familiarize yourself with the location and limits of the area as well as the conditions that apply within it.

These are the types of shadings and warnings you will find:



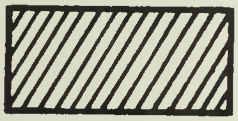
Never Fly Over Prohibited Areas

1. Prohibited Areas (Air Space Reservations) are areas from which all aircraft, except those engaged in actual defense missions, are prohibited. At present there are two such areas established in the United States by executive order: **Washington, D. C. and Hyde Park, New York.** The former may be avoided by flying close on course when near the Capitol.



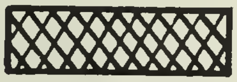
Keep Sharp Lookout in Caution Areas

2. Caution Areas are areas in which under CFR there are **visible** hazards. These areas should be avoided if practicable.



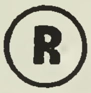
Get Authority to Cross Danger Areas

3. Danger Areas are reservations in which there is an **invisible** hazard such as might exist over an artillery or bombing range. No flight of aircraft shall be conducted in this area without specific authority issued by the agency having jurisdiction over the danger area.



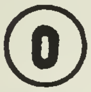
Tunneled Airway

4. Where a **Tunneled Airway** is indicated on charts, through traffic must utilize airspace between 1500 and 3500 feet above ground.



Red Flag

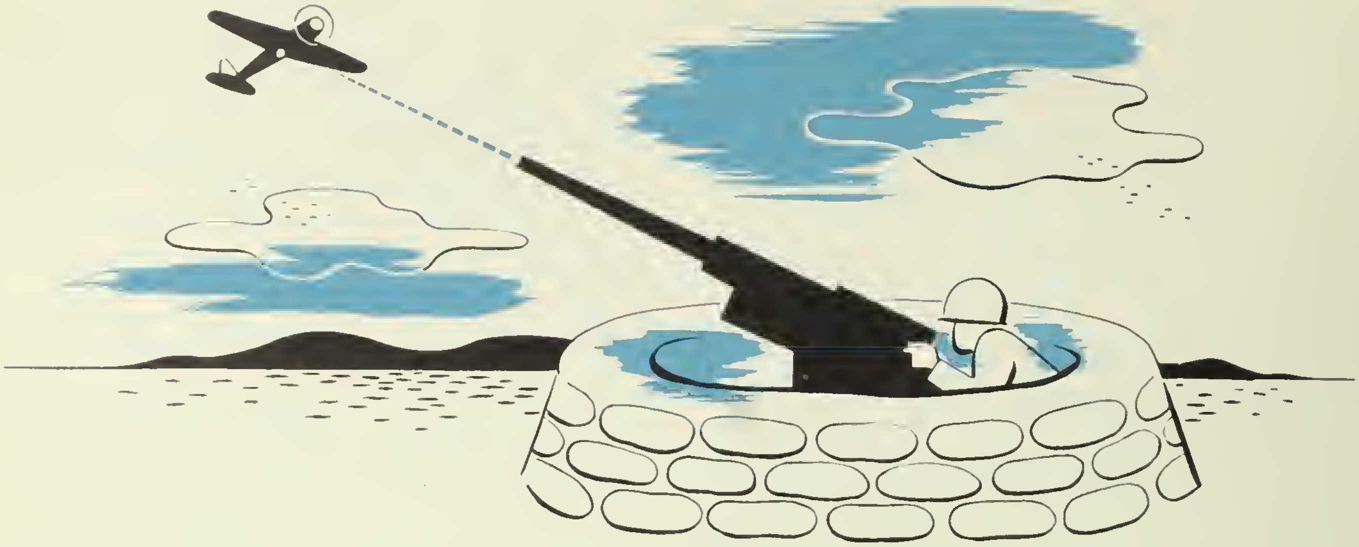
5. Red Flagged Items, or Warnings. This symbol indicates an airport flooded or otherwise closed; range frequency changed; range not operating or course swinging badly; field lights out of commission; special flight restrictions; any decommissioning of a navigational aid.



Orange Flag

6. Orange Flagged Item, or Caution. Indicates airport under partial construction; field soft; control inoperative; etc.

NOTE: When entering Vital Defense Areas on contact flight, it is desirable that you contact the nearest radio station and report your position and receive pertinent instructions.



HAZARDS TO AIR NAVIGATION

Commanding Officers of AAF stations at which there is flying activity, are charged with reporting local conditions affecting flying safety to the proper authorities, so that the information will reach pilots as quickly and easily as possible.

Some of the hazards which you may encounter include: unsafe conditions of landing fields or runways due to construction, repairs, snow, floods, etc.; installation or changes of lighting systems; failure in servicing facilities; congested training areas; aerial, bombing, and gunnery ranges; barrage balloon, searchlight, and certain construction areas; changes in operation of control towers and Army operated radio range or radio beam facilities.

Chief source of information on the existence of hazards or their removal through corrective action is "Weekly Notice to Airmen." Further information can be found in "AAF Radio Facility Charts," "AAF Radio Data and Flight Information," CAA "Danger Areas in Air Navigation", and regional maps. Local operations offices are directed to call your attention to them in issuing clearances. Teletype and Army Airways Communication System facilities are also used to bring them to your attention, and by using Pilots' Advisory Service you can get current news of hazards in the area.

The system used in marking hazards at air fields is discussed in full in "MARKING OBSTRUCTIONS," PIF 2-11-1.

REFERENCE: AAF Regulation 63-1, dated January 1, 1943.

Caution

Don't ignore the precautions taken to safeguard you in flight. Learn everything you can, in advance, about what you will be flying over or the field you will be landing on.

"PRIVATE JONES REPORTING–THEY'RE COWS ON THE FIELD, SIR!"
COMMANDING GENERAL
AIR SERVICE COMMAND

LOW FLYING

Over Cities

In flying over cities and towns, observe all safety precautions possible to eliminate danger to persons and property on the ground.

Except in taking off from fields located in or near populous areas and in climbing immediately thereafter, always maintain sufficient altitude to glide to a landing field in the event of engine failure.

When a mission prescribed by proper authority requires low-altitude flying, the above instructions may be disregarded; but every precaution will be taken to insure perfect functioning of engines, instruments, etc., and the amount of low flying will be strictly limited to that which is necessary to accomplish the mission.

Over Crowds

No flying by any type of aircraft will be done at any altitude over or in the immediate vicinity of stadiums, ball parks, fair grounds, or other localities where crowds are gathered, except those around the borders of flying fields witnessing flying demonstrations. When flying from a field where there is a large crowd of people, take precautions to maintain such position and altitude as will insure the safety of persons on the ground. **Never dive lower than 1,000 feet over or in the direction of crowds of people.**

Over Water

Buzzing water is a particularly dangerous violation of the regulation against unauthorized low flying. It is extremely difficult to judge exactly the distance you are flying above water, particularly when the surface of the water is calm.

An elementary fact about vision is that your judgment of distance is determined largely by the relative size of objects. You make the judgment subconsciously and it is based upon experience accumulated during a lifetime.

A smooth body of water, however, contains no patterns or objects which you can use as points of reference. It is, therefore, easy to misjudge your clearance over water by as much as fifteen or twenty feet—enough to let a propeller strike the water.

The tip of a propeller moving at high speed does not knife through the water, it hits violently, and causes an immediate loss of power; the plane is thrown out of control, and a major catastrophe is almost inevitable.

Remember

Unauthorized low flying over cities and towns, diving over crowds, buzzing of any kind, and flying through or over Prohibited Areas are subject to disciplinary action.

PIF 2-7-1
May 1, 1943

CREW REQUIREMENTS FOR MULTI-ENGINED AIRPLANES

Multi-engined aircraft, the cockpits of which are arranged for side-by-side seating of pilot and co-pilot, ordinarily will be operated with a co-pilot. However, commanding officers may authorize the operation of such aircraft with a minimum pilot crew of one pilot, provided the pilot is accompanied by a crew chief or aerial engineer who is thoroughly familiar with the mechanical operation of the airplane.

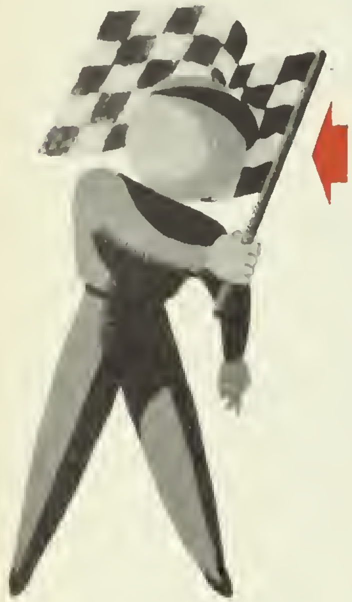
Two-engined aircraft with a single pilot cockpit and two-engined advanced training type aircraft may be operated by the pilot only, when in the opinion of the commander concerned other crew members are not required to perform the mission.

Commanders may authorize changes in these requirements in cases of military necessity.

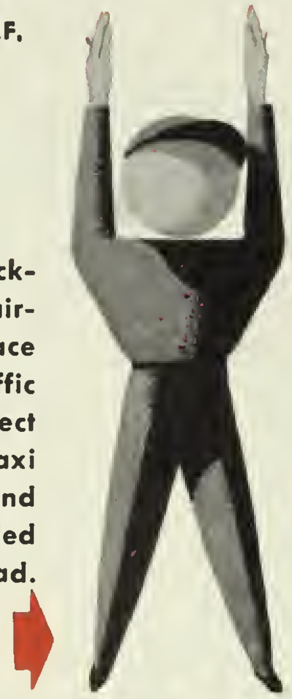
REFERENCE: AAF Regulation 55-5.

Hand Signals for Taxiing

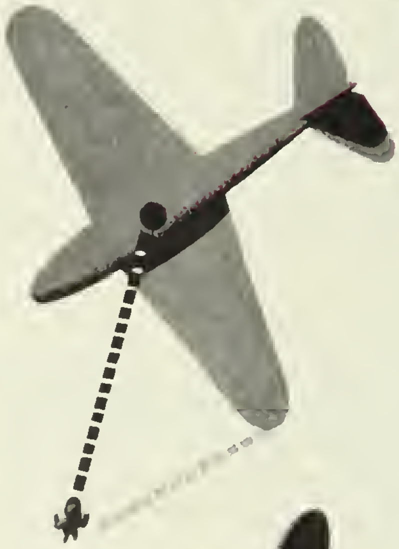
THESE SIGNALS, PRESCRIBED BY AAF REGULATION 62-10, DATED 2 AUGUST 1943, REPLACE ALL FORMER TAXI SIGNALS. THEY WILL BE USED BY CREWS OF AAF, USN, USMC, RAF, RCAF, AND RN.

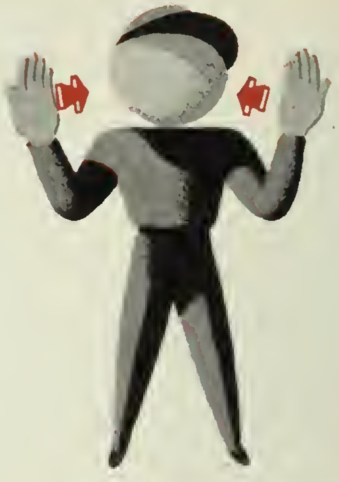


A FLAGMAN with checkered flag will meet aircraft on any landing space where the nature of traffic demands it. He will direct the pilot toward the taxi signalman who will stand with both arms extended full length above his head.



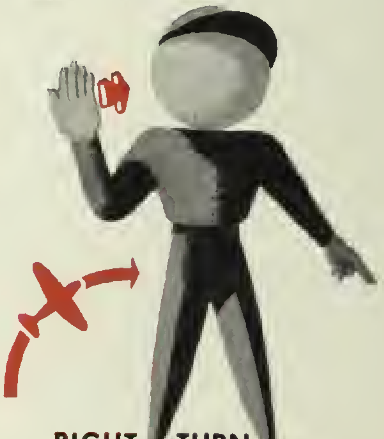
THE SIGNALMAN will direct taxiing from a position forward of the left wing tip of the airplane, where the pilot can see him easily all the time.



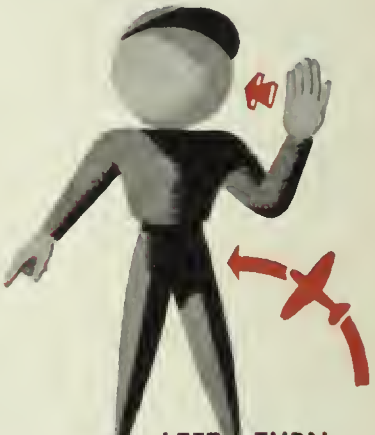


COME AHEAD

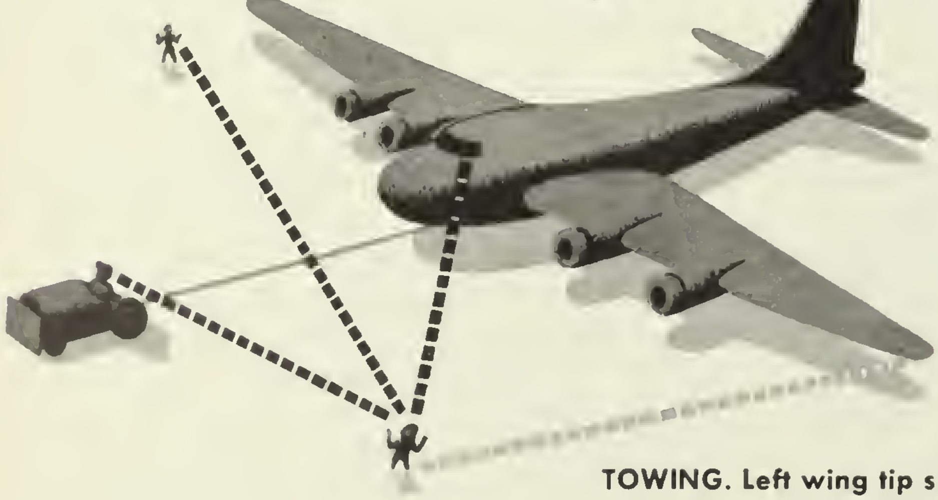
To signal turns, signalman will beckon "Come Ahead" with hand on the same side as the wing to be brought around, and point with other hand at wheel to be braked.



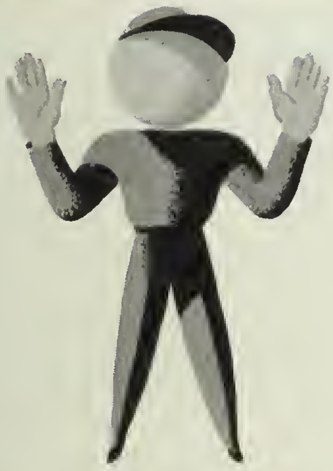
RIGHT TURN



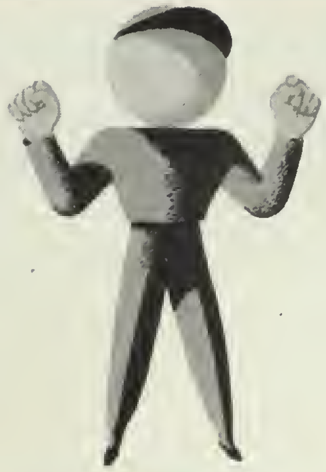
LEFT TURN



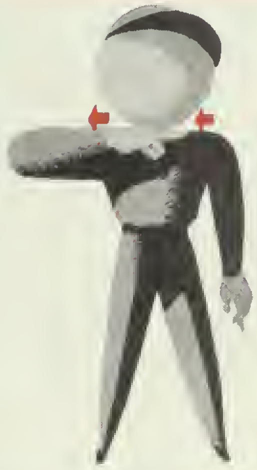
TOWING. Left wing tip signalman gives all signals to tractor driver.



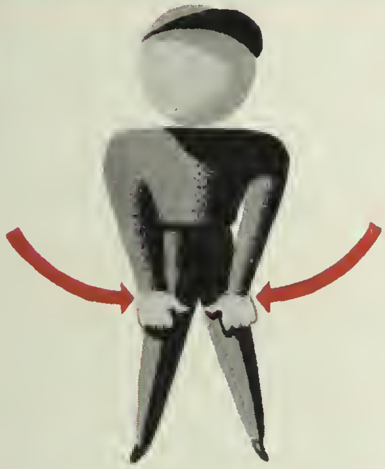
STOP



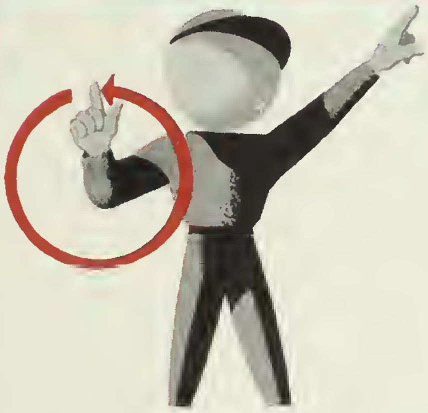
EMERGENCY STOP



CUT ENGINES

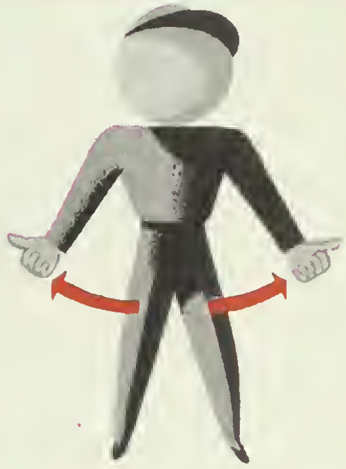


INSERT CHOCKS

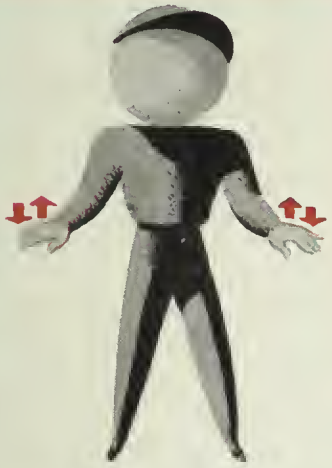


START ENGINE

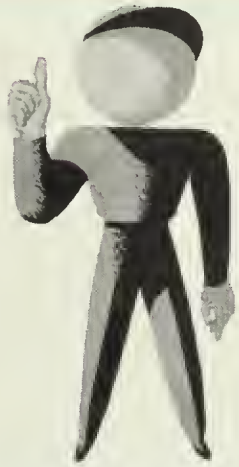
First signal "Emergency Stop." Then point one hand at engine to be started. Rotate other hand.



PULL CHOCKS

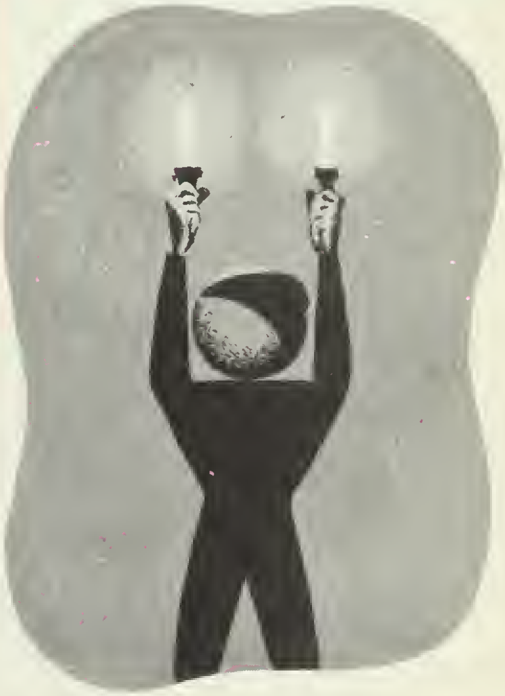


SLOW DOWN



ALL CLEAR (O.K.)

NIGHT OPERATION



Where illumination permits, signalman will move in lighted area and use above signals. Out of lighted area, he will use flashlights or, if available, Lucite wands. All signals same as above except "Emergency Stop," which will be given by crossing lights in front of face.

Takeoff and Landing Precautions

Be alert all the time: On the ground, in the air, every minute you are in an airplane. As a pilot you are responsible for **your airplane and everybody on board.**

To be alert all the time develop a simple routine habit of looking **automatically in the right places** under all conditions. If you maneuver your airplane around its three axes while looking around you can eliminate all blind spots.

Any maneuver that may result in excessive loss of altitude **demands extra alertness.**

If tower orders you to clear the runway, taxi off unless checks are complete. Never take off until ready.

Taxiing

1. Before leaving ramp contact control tower for proper taxiing instructions.
2. **Taxi slowly** and on hard surface areas unless otherwise advised.
3. Don't drag your brakes. If you overheat them they may lock in the air.
4. Use your upwind engine if taxiing multi-engine airplanes crosswind.
5. **Take nothing for granted.** If you can't see, fishtail right and left far enough to **see everything in front of you.**
6. If your radio fails, watch the control tower for instructions by biscuit gun.
7. Remember, over fifty percent of all airplane accidents occur **before takeoff or after landing.**

Takeoff

1. **Use your checklist prior to takeoff.** Run up your engine or engines with the tail of your airplane pointed **away from other equipment**, and, if possible, where the ground is free from sand and gravel.
2. Don't stand with your engine or engines running for a long period of time. If you must wait for takeoff any length of time, **turn off your engines.**
3. Stay clear of the prevailing runway until the tower says "clear for takeoff."
4. Observe airfield conditions and all boundary obstructions in the proposed takeoff lane.
5. **Look backward, above, and forward** before pulling onto the runway for takeoff.
6. **Use all the runway.** There is never too much runway if an engine fails on takeoff.
7. Be sure your crew is properly stationed and ready for takeoff.
8. Adjust your seat to the proper position. **Check and double check your seat lock.**

Entering Traffic and Landing

1. Contact tower for landing instructions.
2. **Use your checklist before entering traffic.**
3. **Be alert.** Maintain traffic altitude.
4. Be sure your crew is properly stationed and ready for landing.
5. **Land on the first one third of the runway.** If this is impossible, **go around.** It's no disgrace.
6. Don't relax after landing. Remember, your mission is not complete until you have **parked your airplane on the ramp and turned off the engines.**
7. **Be alert.** Stay within the bounds of safe taxiing, but, **clear the runway** as soon as **possible.**
8. Follow instructions of the alert crew in parking your airplane. Advise the control tower that your mission is completed.
9. **Except in cases of extreme emergencies** don't land on a flying field which is under the process of

construction, until that field has been declared officially open by the proper authorities. Do not construe this order as preventing the landings, when necessary, of aircraft carrying inspection personnel on official business.

Precautions on Muddy or Snow-Covered Fields

When airplanes are operated from muddy or snow-covered fields, the landing gear and tail wheel sometimes clog with mud or wet snow which freezes at the lower temperatures encountered after takeoff. When the gear is retracted, there is danger of its freezing in the retracted position. To avoid this retract and lower landing gear several times after takeoff. If it seems likely that the gear will freeze in the retracted position even after the above precautions have been taken, leave the gear lowered.

Landing with Gear Retracted

Remember that landing wheels-up always results in more or less damage to the airplane, so try everything else first. Then, if the gear won't function properly, and you have fuel enough, try to make the wheels-up landing at a depot or station where there are facilities for extensive repairs.

If you see that you must land with the gear up, and have time, take the following precautions:

1. If carrying bombs, release them in "SAFE" over uninhabited area, at an altitude above 500 feet.
2. If carrying bomb bay tanks, drop them over a suitable area. Leave the bomb bay doors open long enough to get rid of gas fumes.
3. **Close bomb bay doors before landing.**
4. Though flares are not likely to ignite when landing wheels-up, you may drop them from 2000 feet, or at any altitude over suitable terrain.

In emergencies, when you have to land on questionable terrain, or on a field too short for a landing run, extend flaps and land wheels-up.

Exception: In making a forced landing with a B24 the recommended procedure is to **land with gear extended on any type of terrain.**

In case of engine failure with single-engine aircraft on takeoff, if there is not runway enough left, retract wheels and land straight ahead.

Wheels-up Landing on Paved Runways

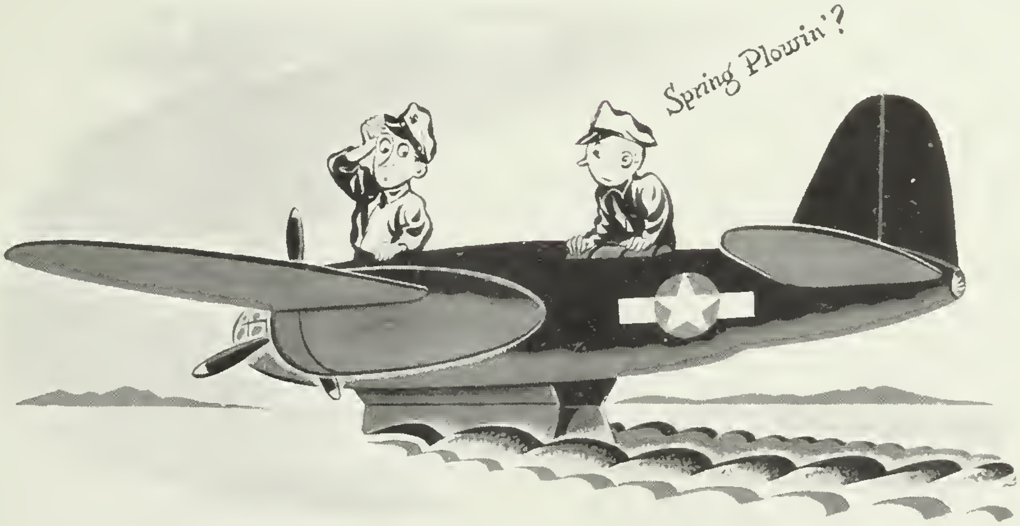
Experience has shown that **it is better to make a wheels-up landing on a paved runway** (where available) than on unpaved terrain. A belly landing on soft ground may result in nosing-up, or digging in and stopping abruptly, which may endanger personnel and cause severe damage to the airplane.

Runway Shoulders

Stay on the runways. Shoulders along runways and taxi-strips have been treated to withstand occasional emergency use; but they are not constructed for hard usage, such as parking, taxiing, or landing.

The lights along the outer edge of the runway pavement indicate the full area to be used for all operations. On fields where no lights have been installed stripes have been painted six inches wide and parallel to the outer edge of the pavement. **The areas outside these stripes are for emergency use only.**

REFERENCES: AAF Regulation 60-6; Technical Order 00-25-6; and Technical Order 01-1-10.


Spring Plowin'?

CHECK LISTS

Use the check lists in the cockpit of your airplane. No matter how familiar you become with your plane, there is always a chance that you'll forget something. Do not rely on your memory. Always use check lists.

Check Lists In Cockpit

EVERY AIRPLANE HAS CHECK LISTS PROVIDED FOR THE FOLLOWING:

1. Before starting engine or engines.
2. During warm-up.
3. Before takeoff.
4. During flight.
5. Before landing.
6. After landing.

If the check lists are not in the airplane, report it at once to the crew chief and see that the proper lists are provided before you prepare for flight.

These check lists are required by regulation, and are to be used not only by pilots who are unfamiliar with the operating procedures of the aircraft, but also by experienced pilots as a continuous refresher in essential operations.

Check List Habit

In training type airplanes it may seem unnecessary to use the check lists, but it is during your training that you form your flying habits.

The Check list habit is a **must** in combat equipment. There is too much to remember, and every item is important. One mistake, one switch improperly set, one instrument overlooked, may spell disaster. Make the check list habit a part of your procedure on every flight whether it's in a PT or a VHB.

Don't Use Memory Checks

The standard memory checks which some pilots use, are no substitutes for the printed check lists in the airplane.

Every model has its own specific check procedure, so don't try to learn a general check list. It will not be applicable to every airplane and may lead to improper procedure. So don't use any standard memory check system.

REFERENCE: AAF Regulation 62-2

MARKING OBSTRUCTIONS

Obstructions in the vicinity of landing fields are marked so that they will be easy for pilots to see as they approach or take off. A standard system of marking is now used by the Army, Navy, and CAA for all uncamouflaged airports in the United States.

Permanent structures are painted orange and white for daytime recognition, marked by red lights so that they are easily spotted at night. Temporary hazards on landing fields are indicated by yellow markers by day and also lighted at night.

Watch for obstructions and hazards when you approach a field, particularly a field new to you. Recognize the markings and appreciate obstruction hazards.

Standard Markings

Radio towers, masts, flag poles, smoke stacks, water standpipes and other similar structures are painted in alternate bands of orange and white. Mounted water tanks are painted in a checkerboard design of the same colors. The tops of tanks and standpipes are divided into eight segments, which are painted alternate orange and white.

Where hangars or other buildings are situated within a normal landing area or landing approach, so that they constitute a hazard, the roofs are painted with an orange and white checkerboard design so that they stand out clearly.

Marking by Lights

From sunset to sunrise, and at other times when visibility is poor, obstructions are marked with bright red lights so that they are easy to spot. The lights outline the obstructions from every angle of approach.

Guy cables for structures in the immediate vicinity of landing fields will be marked with a danger cone at the midpoint of each cable.

Hazardous Areas on Airfields

Holes, soft spots, construction, or other conditions which make any area of a landing field unsafe for use, are marked with yellow flags or pyramids during the day and with red lights at night. The unsafe portions are outlined; and if the area is large, it is also marked with a cross of flags or lights placed in the center of the area.

A large cross of flags, colored material or red lights at each end of a runway, marks it as unsafe for use at the time.

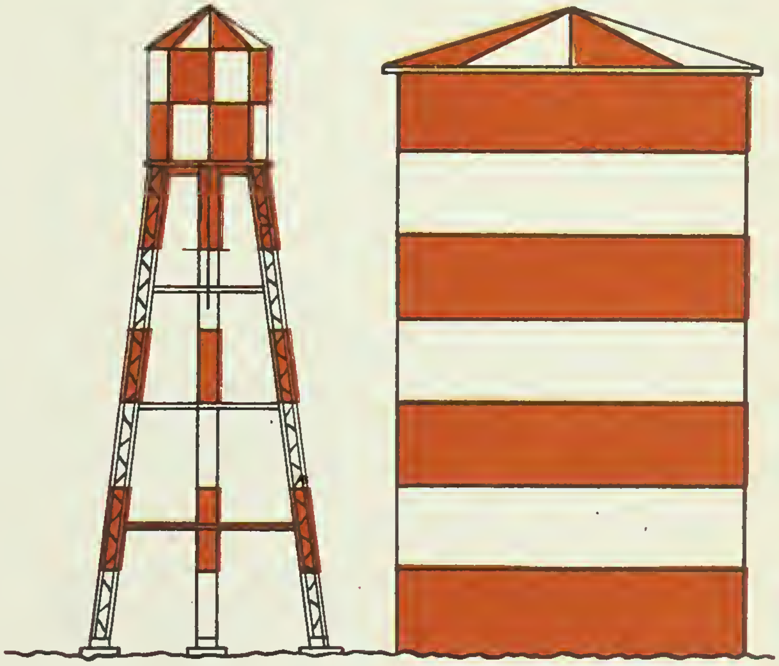
Along Airways

Any structure which projects above the surrounding terrain so that it can be considered a serious hazard, is marked according to the same system of orange and white markings and red lights, whenever it is possible to do so. However, often it is impractical to mark some structures, so allow altitude sufficient to clear all obstructions and variations in the terrain while in flight.

Exceptions

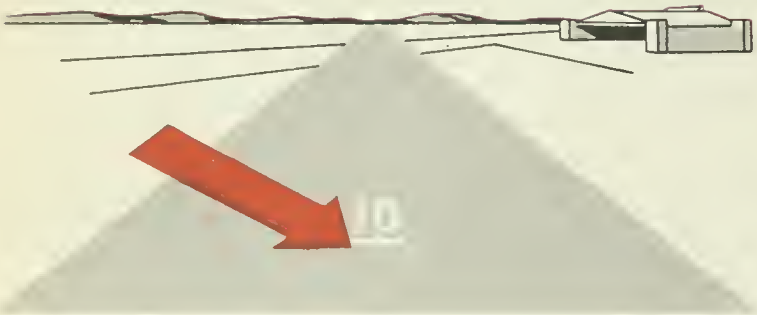
Although every attempt is being made to standardize marking and lighting, local conditions and camouflage or blackout requirements make deviations necessary. Until you are familiar with local marking procedure, use extra caution while in flight.

REFERENCE: Army Regulation 95-35, AAF Regulation 62-5, and Technical Order 19-1-20



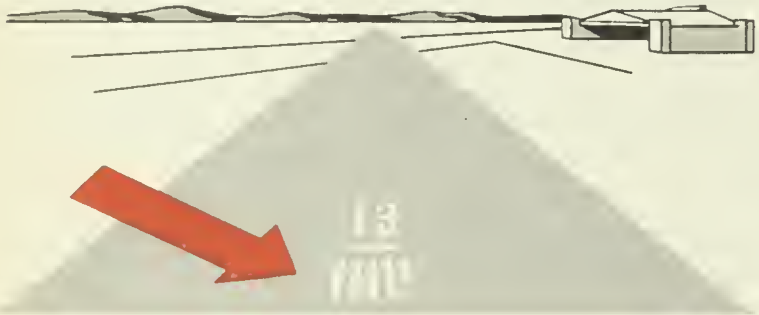
DOMESTIC RUNWAY MARKINGS

Runway and landing strips on uncamouflaged airfields in the zone of the interior are marked to aid in the control of traffic and to help the pilot. Runways are marked in black or white, the color having the greatest contrast to the runway surface. Taxiways are marked in yellow.



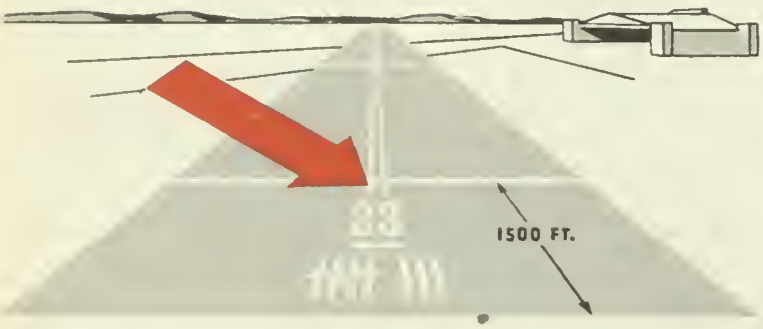
EACH RUNWAY IS NUMBERED

The numbers indicate, in units of ten degrees, the approximate magnetic bearing of the runway. A large "R" for Right and "L" for Left, designates parallel runways.



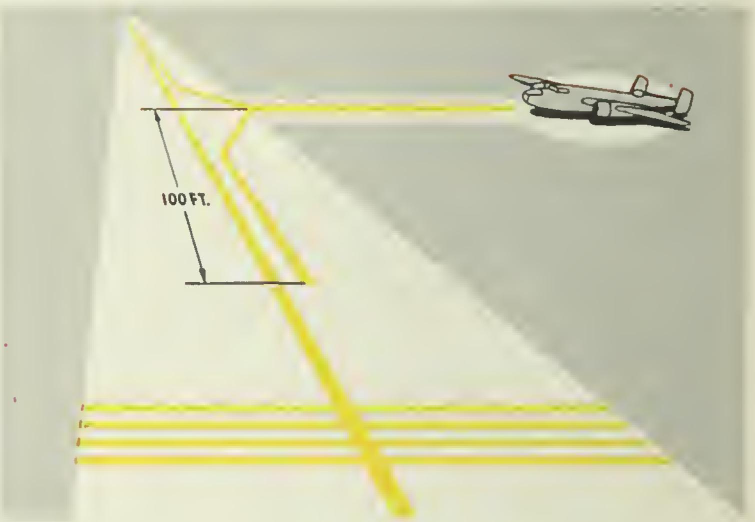
RUNWAY LENGTH SHOWN BY VERTICAL BARS

Up to 4500 feet, each vertical bar represents a thousand feet, a half bar, 500 feet. Each five thousand feet is indicated by four vertical bars with a cross bar intersecting the verticals. Length over 5000 feet is indicated to the nearest thousand by additional vertical bars.



BANDS RUN LENGTH OF EACH RUNWAY

They extend down the center to within 25 feet of the numerals on each end. A band is painted across the runway 1500 feet from each end.



YELLOW STRIPES FOR TAXIWAYS

Taxiways are marked by a single yellow center stripe, with guide stripes for turns into hardstands, aprons, etc. A yellow cross band warns of approach to within 100 feet of a runway. Where taxiways intersect runways, the yellow taxiway stripe extends to the adjacent runway stripe.

Camouflaged airfields in the zone of the interior will be marked as authorized by the Commanding General, Army Air Forces.

Airfields in the theater of operations will be marked as authorized by the Theater Commander.

REFERENCE: Technical Order 00-25-7.

CAMOUFLAGE

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Lack of strict camouflage discipline at an airdrome can ruin the whole camouflage scheme. The simplest human activities leave marks on the earth which are visible from the air. Men around an airdrome leave distinctive marks, easily identified by aerial observers as being the "spoor" of an army flying field. To keep this "spoor" at a minimum everyone must obey strictly the rules laid down by camouflage authorities on the airdrome.

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Camouflage is designed to reduce visibility and conceal identity. It is accomplished by disruption, disguise, and concealment.

Officers charged with the layout and execution of camouflage will do everything possible to protect you and your plane; but as a pilot you have a special responsibility. You are in command of your plane on the ground as well as in the air.

Protect Your Aircraft

Just because your plane is normally taken care of by your crew chief after you have landed, don't forget that the safety of your plane is still your responsibility.

The necessity of thinking about your plane while it is parked on a continental airfield may seem unimportant to you, but when you set down at an airfield in a Theater of Operations, it will become vital. Then you will realize the importance of having trained yourself to think about your plane all around the clock.

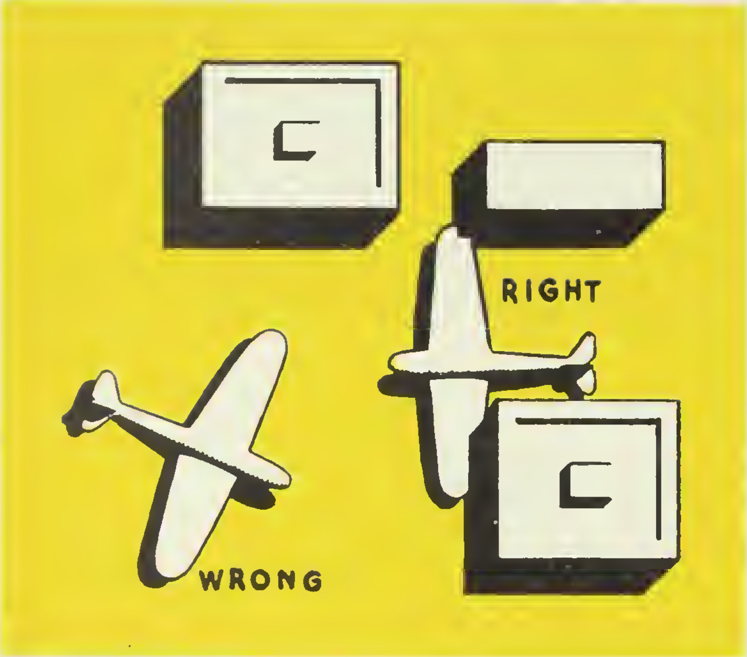
The enemy likes nothing better than to find a group of planes standing in a line, wing tip to wing tip—an ideal target! If you have unthinkingly contributed to creating such a target you may suddenly find yourself without a plane. This means that upon landing in any theater of operations you must automatically take additional precautions in parking your plane—just in case the enemy starts bombing or machine gun strafing.

Here is a check list to remember:

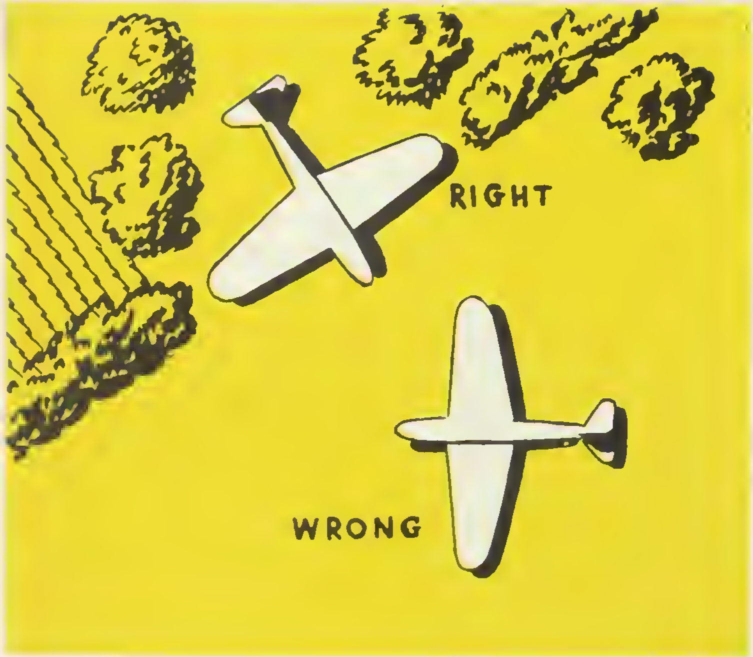
1. See that your plane is parked a reasonable distance from runways; they invariably are primary objectives for bombing attacks.

2. See that it is parked at least 400 feet from any other plane; all other things being equal.

3. Park your plane near to trees, buildings or any other objects which make it less conspicuous and break up the distinguishing shadow cast by any airplane.



4. If it is in an open field, a plane parked along a hedgerow, at the junction between two or more fields, or near low scrubby bushes is more difficult to see from the air.



5. Anything thrown over the cockpit greenhouse, windows or Plexiglas nose will kill the reflections which might be a dead give-away.

6. Park it so you can taxi out quickly in an emergency.

Don't park your plane close to and in line with other planes.

When you are operating from a dispersed position on an airfield in a theater, always think about these precautionary measures:

1. Always taxi to your designated dispersal point immediately upon landing.

2. Don't leave that position until you know you can take off soon after reaching the runway.

3. Don't jam up behind other planes on a taxiway leading to the take-off position. The unexpected might happen, resulting in a string of dead ducks.

That is just the sort of target the enemy likes—where he can eliminate planes and combat crews with a minimum of effort.

Make it tough for the enemy if he does sneak in! Just remember these simple facts:

1. If your plane is in a dispersed position he will have more trouble finding it.

2. Even if he does bomb or strafe, the chances are good that you will still have a plane when the attack blows over.

3. Follow the instructions of your camouflage officer in all matters of dispersion and discipline.

4. Make your crew members conscious of this problem also.

5. If necessary ask your camouflage officer to request suitable nets from the Theater Service Center for further protections of your aircraft.

Continually train yourself so that it becomes second nature to **think about the safety of your plane on the ground as well as in the air.**

Radio Equipment

Turn on radio equipment by switching on:

1. **The airplane battery switches.**
2. **The master switch.**

THE JACKBOX

The pilot and crew members use the jackbox to connect microphones and headsets to various pieces of radio equipment in the airplane. Following is a list of jackbox positions and their uses:

Compass

The "COMP" position is used to listen to the radio compass receiver. You cannot transmit with jackbox in this position. The compass does not include transmission facilities.

Liaison-VHF

Use "LIAISON-VHF" to transmit and receive with VHF equipment. To transmit, press microphone button-switch. To receive, release microphone switch.

If your jackbox does not have a "VHF" position, the liaison equipment will be connected to that position. Use the same procedure for operating both.

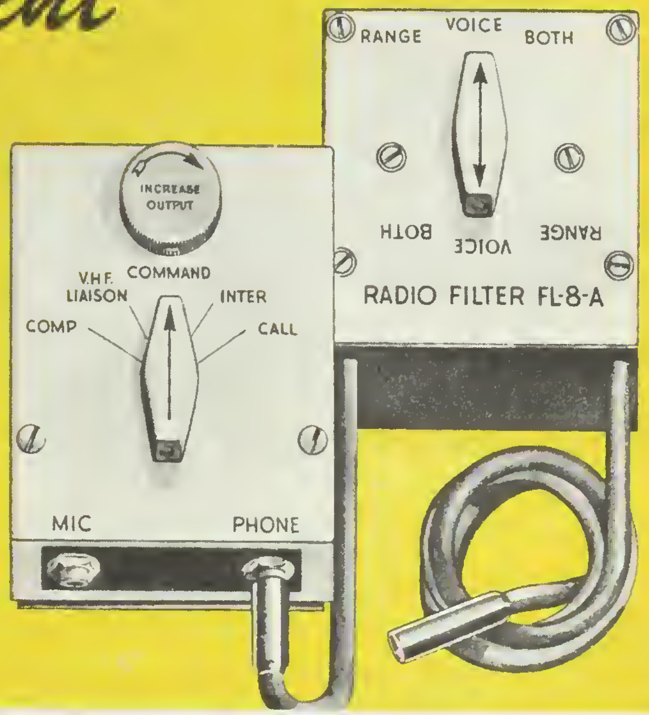
Command

Operation in the "COMMAND" position is the same as in the "LIAISON-VHF" position, except that the medium frequency command equipment is controlled. If the jackbox has no "VHF" position, a separate "MED FREQ-VHF" or "274-522" switch is provided for switching the microphone circuit to either of the command sets.

Inter

Use "INTER" when you want to communicate with any other crew member, whose jackbox is also on this position. Press microphone button-switch to talk. Release it to listen.

CAUTION: Interphone operation is seriously impaired if more than one microphone switch is depressed at the same instant. Don't attempt to speak while someone else is using the system, unless your message is urgent.



Jackbox and Range Filter

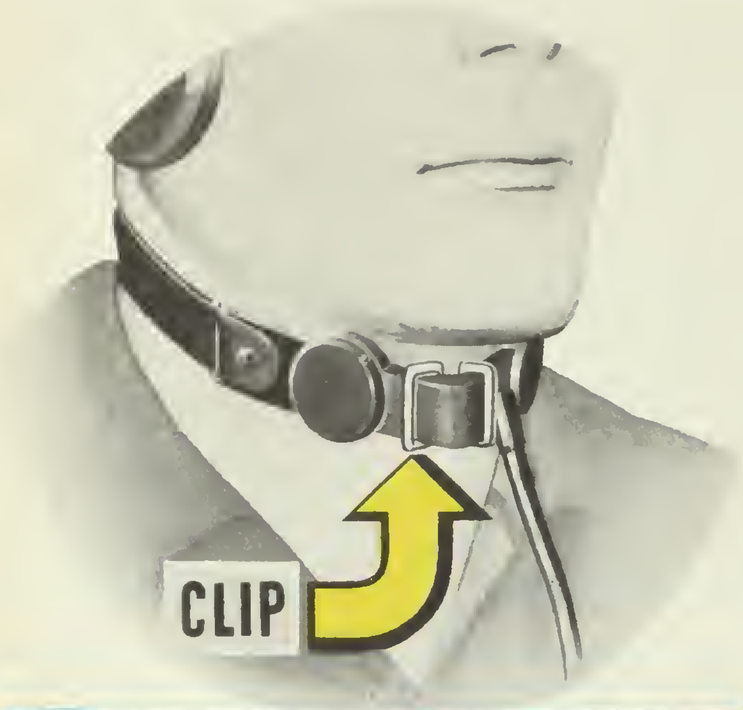
Call

When you want to call another crew member to the "INTER" position, use "CALL". To operate you must hold the jackbox switch in the "CALL" position, and at the same time press the microphone switch. After calling, immediately return the jackbox switch to "INTER" while awaiting an answer, since "CALL" position blocks all other reception and gives precedence to the person calling. To answer, the person called switches to "INTER" and proceeds with normal interphone communication.

RADIO RANGE FILTER

The radio range filter system is used by the pilot or copilot to select either voice or range signals, when both signals are being transmitted simultaneously by the radio range station. When the selector is on "RANGE" position you can listen only to the 1020 cycle A and N signals. When the switch is on "VOICE" the A and N signals are filtered out to facilitate reception of speech. When switch is on "BOTH" the filter is out of the circuit, and you can hear both speech and A and N signals.

Remember, when the filter system is in "RANGE" position interphone operation is blocked. Never allow both pilot's and copilot's filters to be in this position at the same time.



Use your microphone PROPERLY

1. The microphone should fit firmly about the throat, with the buttons spaced equally on each side of your Adam's Apple and slightly above it.

2. Place the strap slightly higher than the microphone level to maintain this position.

3. Don't allow clothing to get between the buttons and your throat.

4. You will get better reception by placing the positioning clip between the buttons.

5. Be sure the proper sides of the buttons are against your throat.

6. Speak as loudly as you can, but don't shout.

T-17 Hand Microphone

If your airplane is equipped with the T-17 hand-held microphone, observe the following steps for proper operation:

1. Hold the microphone squarely in front of your mouth, with your lips slightly touching the mouthpiece when speaking.

2. Speak as loudly as you can, but don't shout.

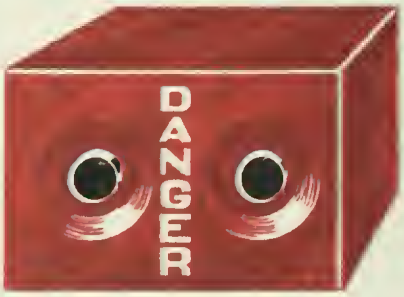
When flying at high altitudes always use the oxygen mask microphone. Always make sure the connecting plugs fit firmly.

LIAISON EQUIPMENT

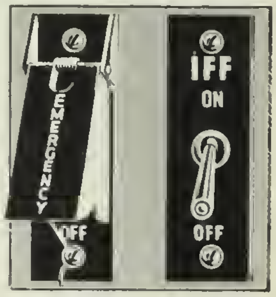
The liaison equipment includes a high-powered long range transmitter and receiver. It is operated primarily by the radio operator. In some airplanes the pilot can operate the liaison equipment by switching the interphone jackbox to "VHF-LIAISON" or "LIAISON" position. If it is necessary for you to use the liaison equipment, ask the radio operator to tune it to the proper frequency. Don't use the liaison transmitter to contact stations within the range of your command equipment, unless it is absolutely necessary.

IFF RADAR EQUIPMENT

Operation of IFF Radar equipment is automatic, once it is turned on. "ON-OFF" switches are provided for the pilot and also the radio operator in airplanes which carry one. The "EMERGENCY" switch, under a springed guard, operates an emergency channel. This switch is usually safety-wired to the "OFF" position. Details of its operation are given at briefing.



Detonator Switches



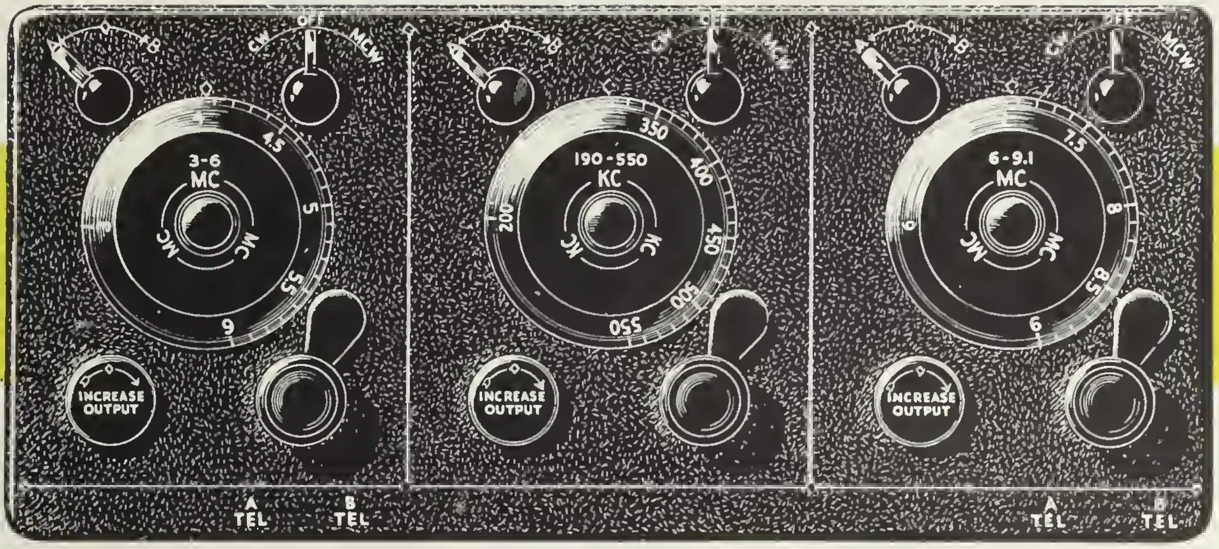
IFF Control Switches

Warning

Your IFF equipment contains two detonator push-buttons.

If you must abandon your airplane in enemy territory, push both buttons simultaneously. They will set off a detonator which destroys the equipment internally, and without danger to you.

There is also an intertia switch that sets off the detonator automatically, if you have to make a crash landing.



SCR- 274N Receiver Control Box

COMMAND EQUIPMENT

Command equipment is of two classes; medium frequency and very high frequency. It is used chiefly by the pilot for voice communication from plane to plane, or from plane to ground when requesting operational instructions. Command equipment is used also to receive radio navigational aids.

SCR-274N Medium Frequency Set

The SCR-274N command set is used for medium frequency command communication. Most airplanes are equipped with two transmitters and three receivers. They are remotely controlled. The two transmitters are usually tuned to the most frequently used channels. With three receivers available, the pilot can use one for receiving navigational signals, and the other two for monitoring stations along the planned route.

Receivers

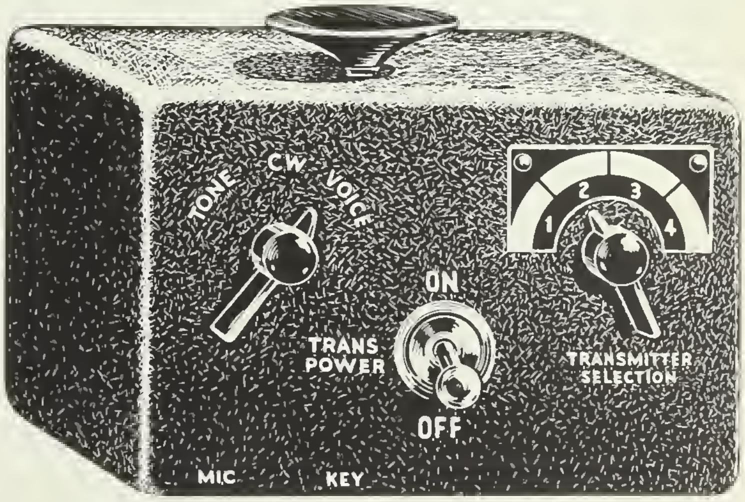
All three receivers are controlled from the same remote control unit. The operating frequency ranges of the receivers are found on the calibrated dials of the control unit. These dials are calibrated either in kilocycles or megacycles. A megacycle is 1000 kilocycles. The receivers are capable of receiving continuous wave or modulated signals. Their outputs are fed into an "A TEL" or "B TEL" line. The "A" line feeds into the "COMMAND" position of the interphone jackbox. The copilot may plug his headset into the "B TEL" jack on the control unit if it is ever necessary to receive two stations simultaneously. If the "B TEL" line is used, the "A"-"B" selector switch on the control of the receiver being used must be in "B" position.

To operate receiver:

1. Turn "CW-OFF-MCW" switch to the type of reception desired. For voice reception turn to "MCW" position.
2. Place "A"-"B" switch to desired channel. Remember the "A" channel feeds the "COMMAND" position of the interphone jackbox.
3. Turn the dial crank to the desired frequency.
4. Adjust the volume to a level comfortable in your headset.

Transmitters

The remote control unit which operates the transmitters has a "TRANSMITTER SELECTION" switch to enable the use of four transmitters. Since there are, however, usually only two transmitters installed in an airplane you will use only number "1" and "2" positions. By turning to position "4" you can use the sidetone of the modulator unit for an **emergency interphone.**



SCR-274N Transmitter Control Box

To operate transmitters:

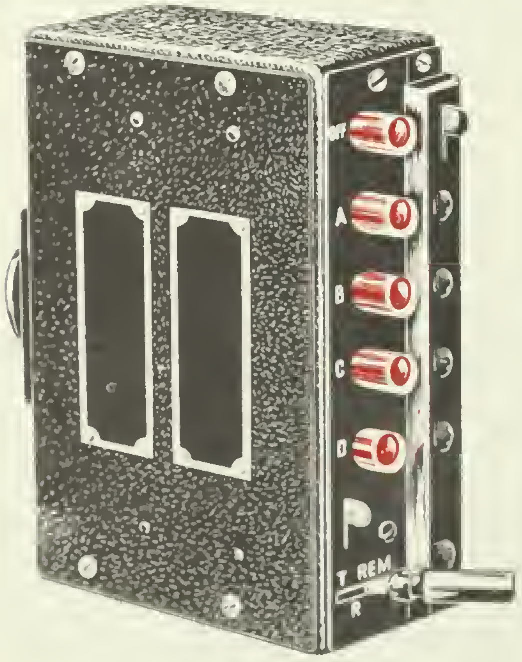
1. If the VHF command set is not connected to the "VHF-LIAISON" position of the interphone jackbox be sure the "MED FREQ-VHF" or "274-522" switch is in "MED FREQ" or "274" position.
2. Select the proper transmitter with the "TRANSMITTER SELECTION" switch.
3. Select the type of emission desired: "TONE-CW-VOICE".
4. Turn "TRANS POWER" switch "ON".
5. Allow the tubes about 10 seconds to warm up before pressing microphone push-button.

A key is mounted on the top of the transmitter control unit so that you can transmit either tone or CW. The normal transmitting range of the SCR-274 is approximately 25 miles. However, in the absence of atmospheric and local disturbances, you can obtain ranges up to 100 miles.

SCR-522 Very High Frequency Set

The SCR-522 set is used for VHF (line of sight) command communication. The transmitters and receivers operate on four pre-tuned crystal controlled channels. You can select any one of these four receiver or transmitter channels from the pilot's compartment. Consult your communications officer for the functions of the four channels.

The "A-B-C-D" push-buttons turn the equipment on, and select the respective channels. The green lights alongside the buttons indicate the channel selected. The lever tab directly above these lights controls a dimmer mask. The "OFF" button turns the equipment off.



SCR-522 Control Box

To operate the SCR-522:

1. Press the desired channel push-button.
2. Place "T-R-REM" switch in "REM" position. The lever tab directly above the switch must be up to allow it to be placed in this position. The switch is usually safety-wired or permanently fastened to "REM". With the switch on "REM" the receiver will be in operation at all times, unless the microphone button is depressed. While the button is held down the set will be in "TRANSMIT" position. If there is no "VHF" position on your interphone jackbox be sure the "MED FREQ-VHF" or "274-522" switch is in "VHF" or "522" position. This connects the microphone to the input circuit of the transmitter. The distance range obtainable with the SCR-522 is limited to line of sight transmission (i.e. at an altitude of 5000 feet the line of sight distance is approximately 90 miles, at 10,000 feet 120 miles).

Operating Tips, Command Sets

274N Set: Transmission on frequencies at which this set operates vary from month to month and from day to day, because of changes in atmospheric conditions. Signals are stronger in the winter than in the summer, and may vary from hour to hour on a summer day.

At certain times of the day signal fading is so rapid it produces severe distortion of voice signals. Signal fading increases with an increase in distance of transmission.

522 Set: Occasionally you will observe dead spots when the metal structure of another airplane gets between the antenna radiation pattern of the communicating airplanes. You can correct this by maneuvering the airplane so that the disturbing structure is removed from between the airplanes.

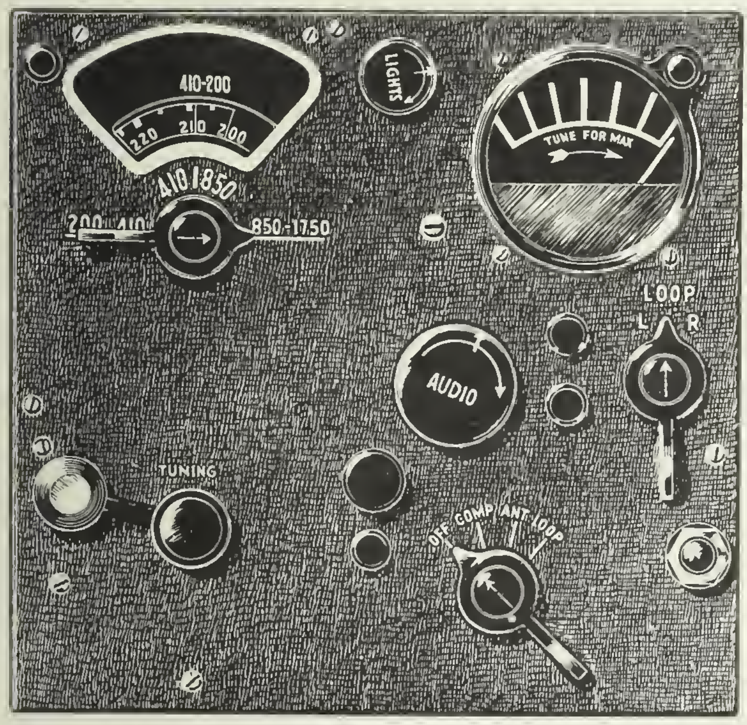
RADIO COMPASS RECEIVER

You may use the radio compass for radio reception, for homing, or for taking bearings on a radio transmitting station. Two antennas are used with the receiver, one of them directional, the other non-directional. Complete controls for operating the radio compass are located in the pilot's compartment, and also in the navigator's or radio operator's compartments. As a pilot you are primarily concerned with homing, and using the radio compass receiver to receive navigational signals, when static or other interference prohibits the use of command receivers.

Operation for Homing

1. Place the interphone jackbox switch in "COMP" position.
2. Place "OFF-COMP-ANT-LOOP" switch in "ANT" position.
3. Push "CONTROL" switch, hold in for a few seconds until green light comes on.
4. Select the proper frequency range either "200-400", "410-850", or "850-1750" kilocycles.
5. Turn the tuning crank to the frequency desired, rock it back and forth over this setting until you obtain a maximum reading on the "TUNING METER".
6. Place the "OFF-COMP-LOOP-ANT" switch on "COMP".
7. Maneuver the airplane until the radio compass indicator reads zero. The airplane is now headed for the transmitting station. Remember, when homing on a station you are heading for the transmitting towers, which are usually located outside of towns.

If the indicator points to the right of zero, the station is to the right. If it points to the left the station is to the left. The homing operation of the instrument is such that the airplane will arrive ultimately over the radio station, regardless of drift. The flight path, however, will be a curved line and coordination with ground fixes or landing fields will be difficult. By trial and error you can fly the airplane on a relatively straight line course by offsetting the heading to compensate for wind. A decreasing magnetic bearing indicates a wind from the left, an increasing bearing a wind from the right.



Radio Compass Control Box

Radio Compass Indicator

Operation for Range Reception

1. Place "OFF-COMP-ANT-LOOP" switch to "ANT".
2. Tune in radio range station. Keep the interphone jackbox volume control turned fully clockwise, and the volume of the radio compass as low as possible.

If reception on "ANT" is poor because of precipitation static, switch the function switch to "LOOP". Rotate the loop antenna by means of the "LOOP L-R" switch for maximum volume in the headsets. Keep compass volume control as low as possible.

If the loop is in the null position when flying on a radio range course, the signal may fade in and out and be mistaken for a cone of silence.

Cone of silence indications are not reliable on loop type range stations when the receiver is in "LOOP" position. Directly over the station the signal may increase in volume to a strong surge instead of a silent zone.

Never use "COMP" position for flying the radio range. The course might appear much broader than it actually is.

For details of radio compass operation see Technical Order 30-100B-1.

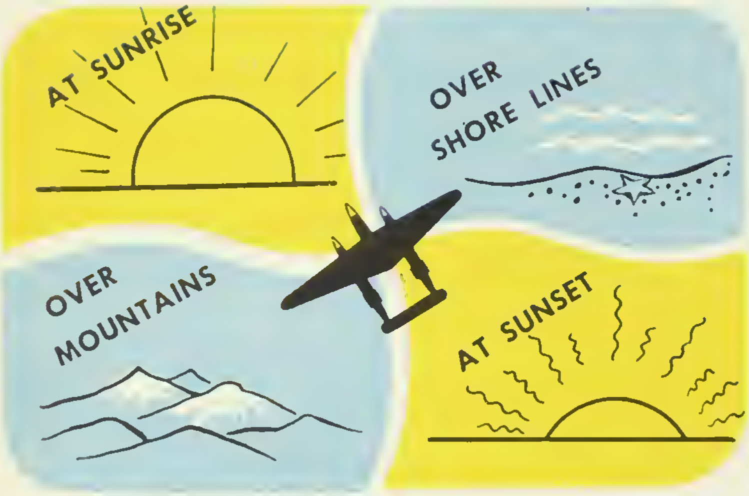
MARKER BEACON RECEIVER

The marker beacon receiver indicates visually to the pilot that the airplane is passing through the radiation field of a marker beacon transmitter. These transmitters are used to mark locations of radio range stations, to indicate range course intersections, boundaries, and position when making an instrument approach landing. The length of visual indication depends upon the type of marker station and the altitude of the airplane. A station marker indication lasts approximately one minute at 10,000 feet, if the airplane is flying at 150 mph.

Marker beacon transmitter locations and keying data are found in your Radio Facility Charts.

To operate: Turn on radio compass, as it furnishes the power for the marker beacon receiver.

POLARIZATION ERRORS



The radio compass was designed to serve primarily as a navigational aid in flying. So long as it is used in this capacity and its limitations recognized, it is a useful and valuable device. Unfortunately, in actual flight, there are certain periods when the instrument's indications are not correct. This is caused by radio wave polarization errors. Failure to recognize these errors can throw you far off course, and make you mistrust the compass.

The principal polarization error is **night effect.** Other causes of faulty bearings are **mountain effect, shore-line effect, and magnetic disturbances,** such as those found in auroral zones of polar regions.

Ordinarily, for homing, the radio compass receiver depends on reception of vertically polarized radio waves. However, when these waves are reflected from the sky they may change polarity and become horizontally polarized. These horizontally polarized waves conflict with the vertically polarized waves and cause fluctuations in the reading of the radio compass indicator.

Night Effect

Since radio waves are reflected in greater strength by night than by day, the opposition of horizontally opposed waves is stronger at night. Errors caused by this phenomenon are called night effect.

Polarization errors may flare up for a few seconds at intervals through the day, and cause the needle to hunt more than normally about the bearing. Real night effect causes hunting of more than 30 seconds' duration. Variations in the intensity of this hunting may be conveniently classified into two types.

In less severe form, the indicator hunts over a total angle of 15° or less around the true bearing; and often a bearing with an accuracy of 5° can be taken by computing a mean reading. In more severe cases the indicator moves constantly, usually through a wide angle and not around the proper bearing. Therefore taking an average of the fluctuations is not possible. You sometimes encounter short periods of nearly normal operation during these periods of extreme instability.

The times at which night effect begins vary considerably, even on the same station. Usually, the first and last disturbances appear during the periods just before sunset and just after sunrise. The errors increase with an increase in frequency, or in the distance of the airplane from the station.

Remedies

Night effect recurs frequently. However, there are definite steps with which to combat it. First, recognize it by remembering that a period of fluctuation in the bearing indications lasting more than 30 seconds is a sure sign. Then try the following:

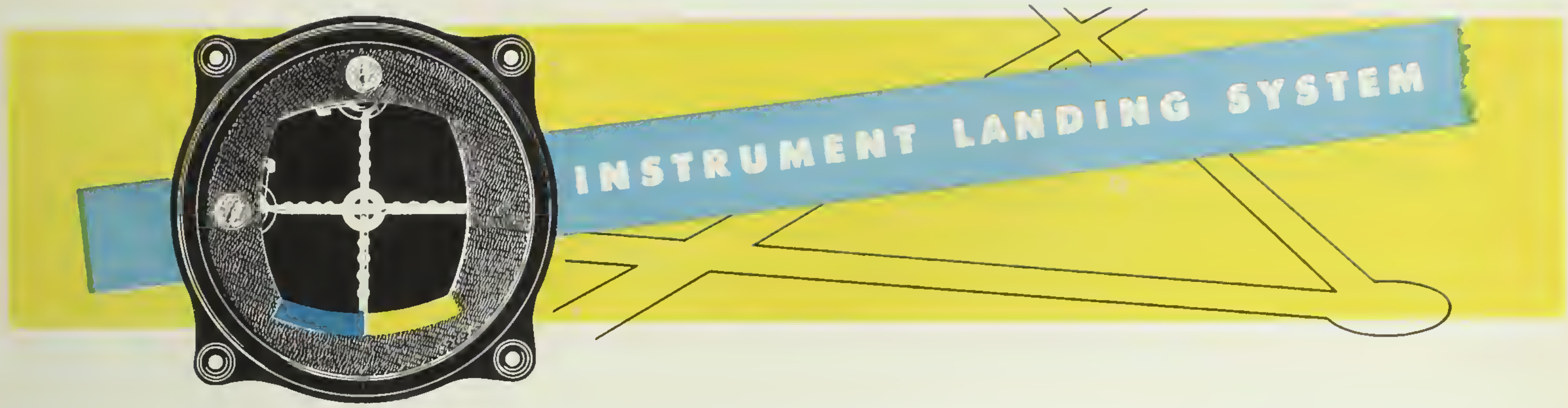
1. Use other methods of navigation to check the bearings.
2. Increase altitude.
3. Average the fluctuations if possible.
4. Select a station of lower frequency.
5. Remember that comparatively large errors are tolerable for purposes of homing, since accuracy increases as the distance diminishes.

Other Effects

You may notice fluctuations when flying across coast lines when the radio waves cross the coast at acute angles. Errors may occur, also, when you are flying over certain mountainous regions, and, to a limited extent, through cold fronts.

RADIO ALTIMETERS

There are several types of radio altimeters. Consult the operating instructions for the particular equipment installed in your airplane.



Instrument Landing Indicator

The SCS-51 Instrument Landing System provides the pilot with a straight line glide path and a localizer or on-course guidance. Some installations include marker stations to provide a further check on location of the airplane in relation to the airport. The airborne equipment consists of a localizer receiver, a glide path receiver, a visual indicator, and a control box.

Visual Indicator

The visual indicator shows you the position of your airplane with respect to the localizer and glide paths. The vertical needle registers the blue and yellow localizer course. The horizontal needle registers the glide path course.

Localizer Indications

The vertical needle of the indicator registers the area of the localizer transmitter signal in which the airplane is flying. If the airplane is in the blue-shaded area when making an approach, the needle swings to the left, indicating you are to the right of the runway. The yellow area indicates you are to the left of the runway. These areas do not necessarily indicate the proper landing direction, since the course is transmitted down the approach of front beam and the downwind or back beam. If the airplane is approaching from the back beam the indications are reversed. When they are reversed the needle swings further away from the center as you fly toward the direction indicated.

Contact the control tower for instructions if in doubt. By keeping the needle within a one-quarter scale deflection you are assured of landing within a safe portion of the runway.

Glide Path Indications

The horizontal needle of the indicator indicates the position of the airplane in relation to the glide path signal.

If the airplane is above the desired glide path the needle points downward, indicating the direction in which you must fly the airplane to approach the desired glide path. If the airplane is below the glide path the needle points upwards.

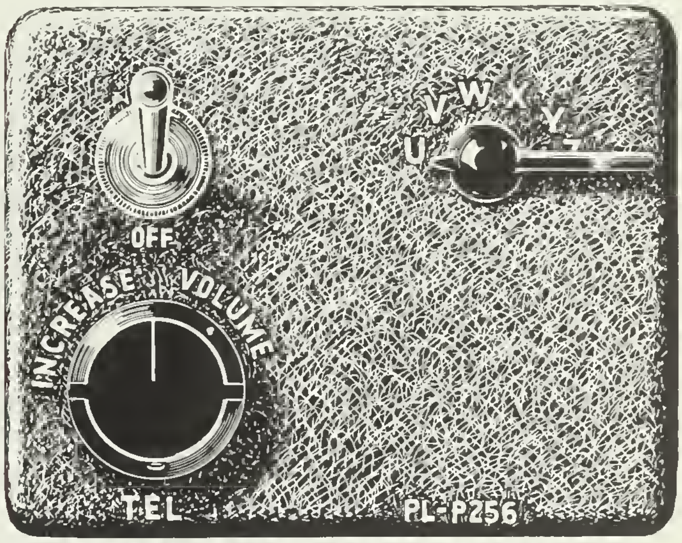
The glide path needle is sensitive. It indicates a full scale deflection when the airplane is 0.3° above the glide path or 0.5° below it. You must align the airplane accurately on the glide path before nearing the field. Only minor corrections are allowable near the field.

The glide path (horizontal) needle points straight up when no signal is being received.

Control Unit

The same unit controls both the localizer and glide path receivers. **To operate:**

1. Turn "ON-OFF" switch "ON".
2. Select the proper channel for the field you are approaching: "U", "V", "W", "X", "Y", or "Z".



SCS-51 Control Box

For complete instructions on the SCS-51 system see Technical Order 30-100F-1.

Radio R/T Procedure

The use of standard radio telephone procedures is the responsibility of all pilots.

Operating Tips

1. Transmit in a concise and business-like manner. Make only necessary official transmissions.
2. Speak slowly. Pronounce each word and number distinctly.
3. Know your message. Group your words so the idea is clear.
4. Don't hesitate. Don't say "uh" and "er".
5. Speak loudly enough to be heard above the surrounding noises.

PHONETIC ALPHABET

When necessary to identify any letter of the alphabet or to spell a word, use the standard phonetic alphabet.

Letter	Spoken as	Letter	Spoken as
A	Able	N	Nan
B	Baker	O	Oboe
C	Charlie	P	Peter
D	Dog	Q	Queen
E	Easy	R	Roger
F	Fox	S	Sugar
G	George	T	Tare
H	How	U	Uncle
I	Item	V	Victor
J	Jig	W	William
K	King	X	X-ray
L	Love	Y	Yoke
M	Mike	Z	Zebra

Difficult words will be both spoken and spelled, for example: "Solved—I spell—Sugar Oboe Love Victor Easy Dog—Solved."

Radio Telephone Terms

"**Roger**" means "Received your message."

"**Wilco**" means "Received your message and (where applicable) will comply." Use "Wilco" to acknowledge you will carry out landing, takeoff, or other instructions.

"**Say again**" means "Repeat."

"**I say again**" means "I will repeat."

"**Wrong**" means "That is incorrect. The correct version is --"

"**Correction**" means "An error has been made. The correct version is --"

"**That is correct**" is self-explanatory.

"**Wait**", if used by itself, means "I must pause for a few seconds." If the pause is to be longer than a few seconds use "Wait. Out." If "Wait" is to be used to prevent another station from transmitting, follow it with "Out."

Pronunciation of Numbers

When you transmit numbers by radio telephone use the following standard pronounciation:

NUMERAL	SPOKEN AS	NUMERAL	SPOKEN AS
0	Ze-ro	5	Fi-yiv
1	Wun	6	Six
2	Too	7	Seven
3	Thuh-ree	8	Ate
4	Fo-wer	9	Niner

Statement of Numbers

Speak all numbers in serial form, as "wun ze-ro" for 10; "ate niner too" for 892.

An even hundred or thousand is spoken as "Hund-red" or "Thow-sand". An exception is made for ceiling and flight levels of ten, eleven and twelve thousand feet. For example:

FLIGHT LEVEL	STATEMENT
1,200	Wun Thow-sand Too Hund-red
12,000	Twelve Thow-sand
13,000	Wun Thuh-ree Thow-sand
15,500	Wun Fi-yiv Thow-sand Fi-yiv Hund-red

Radio Call Signs

Call signs for airplanes are composed of the last three numbers of the airplane serial number. If further identification is necessary, the ground station will request four or more numbers.

Establishing Communication

To establish (or reopen) communication make the initial call-up once, as illustrated in the following example. If you get no reply within 30 seconds make a second call-up, this time making it twice. Repeat this double call-up at 1 minute intervals until communication is established.

Item	Example
Station called	"Scott Army Airways
Introduction	"this is
Station calling	"Army ate wun fo-wer.
Invitation to reply	"Over."

After communication is established you can continue without further call-up, but each message should begin with the airplane's identification and end with the proper termination.

Termination of Message

All messages will end in "Over" or "Out", depending on which is appropriate.

"Over" means "My transmission is ended. I expect a response."

"Out" means "This conversation is ended and no response is expected."

For all frequencies see your
RADIO FACILITY CHARTS

Contacting Ground Stations

Various ground radio communications facilities are at the disposal of the pilot. They include Army Airways Communications System stations, Army or CAA radio range stations, and Army or CAA control towers (See Radio Facility Charts for listings). Examples of call-ups are:

AACS stations	"Scott Army Airways"
Radio ranges	"Scott Radio"
Control towers	"Scott Tower"

AACS

Army Airways Communications System operates control towers, Army airways and radio navigational aids. AACS stations will relay traffic to any point, including CAA or Navy, via telephone, telegraph, teletype, or interphone.

To Prearrange a Channel

Before departing from a base where an AACS station is located a pilot can file a radio message to notify airways stations along the route and at destination to stand by on any air-ground channel.

RADIO DIALOGUE

Takeoff Instructions

Contact the tower for taxiing and takeoff instructions before moving from the line or parking area. Towers should give: (1) Wind direction and velocity and direction of takeoff traffic. (2) Runway clearance. (3) Special instructions for local conditions. (4) Taxi clearance. (5) Takeoff clearance. (6) Altimeter setting. (7) Time. For example:

Plane: "Washington tower, this is Army one five seven, over."

Washington: "Army one five seven, this is Washington tower, over."

Plane: "Washington tower, this is Army one five seven, taxi clearance, over."

Washington: "Army one five seven, traffic northwest, cleared to runway three three. Taxi to front of terminal building, turn right and follow taxi strip. Altimeter three zero zero four, over."

Plane: "Army one five seven, wilco, out."

Plane (in takeoff position): "Washington tower this is Army one five seven, over."

Washington: "Army one five seven, this is Washington tower, over."

Plane: "Washington tower, this is Army one five seven, takeoff clearance, over."

Washington: "Army one five seven, cleared for takeoff, over."

Plane: "Army one five seven, wilco, out."

Washington: "Army one five seven; off at zero five, over."

Plane: "Army one five seven, roger, out."

Remain tuned to the tower frequency for at least 5 minutes after departure, unless cleared to another frequency by the control tower.

Landing Instructions

When approaching a field, contact tower when approximately 10 minutes out, or in time to receive an answer before entering the control zone. Give your position, and stand by for landing instructions. Call tower again about 1 minute from the field and give position.

Clearance to enter traffic pattern is issued to the pilot when it is desired that you approach in accordance with current traffic patterns, and when traffic conditions are such that a clearance authorizing actual landing cannot be given. Information is given concerning landing direction and runway, so you may plan your entry into the traffic pattern. Don't confuse clearance to enter pattern with clearance to land. Landing instructions should include wind direction and velocity, altimeter setting, traffic information, landing sequence, observation of landing gear, and field conditions. For example:

Plane: "Waco tower, this is Army five nine two, over."

Waco: "Army five nine two, this is the Waco tower, over."

Plane: "Waco tower, this is Army five nine two, position one five miles northwest, time zero eight one five at four thousand. Request landing instructions, over."

Waco: "Army five nine two, roger. Cleared to enter right traffic pattern. Traffic south, runway one seven R. Make an overhead approach at one thousand five hundred indicated. Call tower on base leg, over."

Plane: "Army five nine two, wilco, out."

Plane (on base leg): "Waco tower, this is Army five nine two, on base leg, over."

Waco: "Army five nine two, wheels down and locked, cleared to land, over."

Plane: "Army five nine two, wilco, out."

Plane (now on ground): "Waco tower, this is Army five nine two, on ground, taxi instructions, over."

Waco: "Army five nine two, make a right hand turn at first taxi strip. Taxi north on ramp to center control tower, alert crew will park you, over."

Plane: "Army five nine two, wilco, out."

Remain tuned to the tower frequency until you have taxied airplane to parking position and shut off the engines.

CAA Range Stations

Contact CAA radio range stations to report your position, request weather and traffic information, file flight plans, or make changes in flight plans. Report position to range stations in this sequence: (1) Plane's call. (2) Position. (3) Time. (4) Altitude. (5) Flight conditions, such as contact or instrument flight, on top, between layers (include visibility), icing, or turbulence. (6) Estimated time over next fix. For example:

Plane: "Denver radio, this is Army five zero eight, over."

Denver: "Army five zero eight, this is Denver radio, over."

Plane: "Denver radio, this is Army five zero eight. Crossing northeast leg Denver range one five miles northeast, time one six four zero at nine thousand on instruments. Estimate Cheyenne time one seven one five, over."

Denver: "Army five zero eight. Crossing northeast leg Denver range one five miles northeast, time one six four zero at nine thousand on instruments. Estimate Cheyenne time one seven one five, over."

Plane: "Army five zero eight, that is correct, out."

Change of Flight Plan

Give: (1) Plane's call. (2) Position. (3) Time over position. (4) Altitude. (5) Flight conditions. (6) Details of change in flight plan. (7) Remaining hours and minutes of fuel aboard. (8) Estimated time en route present position to destination. (9) Alternate airport. (See PIF 2-3-1.)

Plane: "Washington radio, this is Army three zero eight, over."

Washington: "Army three zero eight, this is Washington radio, over."

Plane: "Washington radio, this is Army three zero eight. Over Washington, time one six one five at six thousand on instruments. Request change in flight plan, six thousand red airway two zero to Pittsburgh. Fuel supply three hours and three zero minutes. Estimate Pittsburgh one hour and one five minutes. Alternate Columbus, over."

Washington: "Army three zero eight, roger, wait, out."

Washington: "Army three zero eight, this is Washington radio, over."

Plane: "Washington radio, this is Army three zero eight, over."

Washington: "Army three zero eight, Washington Airway Traffic Control clears you to two five miles northwest Martinsburg, to cruise at six thousand. Contact Martinsburg radio for Pittsburgh clearance, over."

Plane: "Army three zero eight, roger, out."

VISUAL SIGNALS
FOR
FORMATION FLYING

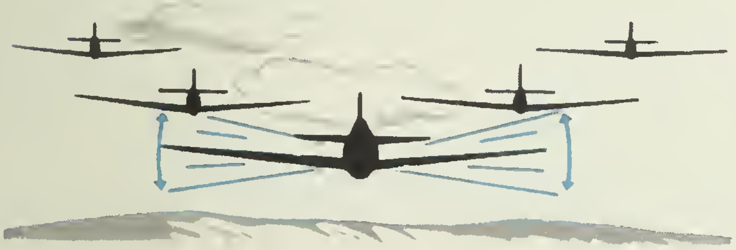
Wartime use of airplanes often will not permit the use of radio to control the formations in which they are flying. The majority of formation training flights also require partial or total radio silence. Consequently, a system of signals is required in order that a commander may exercise proper control of his formation during flight.

Because each type of flying employs formations peculiar to itself and because variety in formations also is caused by non-uniformity of airplane types, it is not considered expedient to prescribe all signals to be used in formation flying.

To insure uniformity throughout the Army Air Forces in certain items of control common to all formations of airplanes, the following visual signals are prescribed:

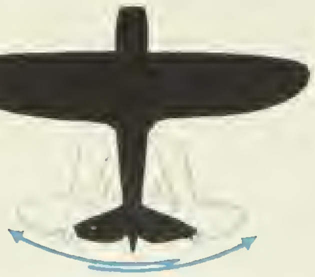
SIGNAL — SIGNIFICANCE

FLUTTER AILERONS: Repeated and comparatively rapid movement of ailerons.



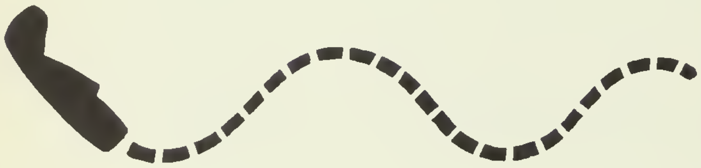
ATTENTION: Used on the ground or in the air to attract attention of all pilots in the formation. Stand by for radio message or further signal. When on ground and in proper position to take off, this signal will normally mean "Ready to take off."

FISHTAIL OR YAW: By rudder control during flight, move the tail of the airplane alternately and repeatedly right and left.



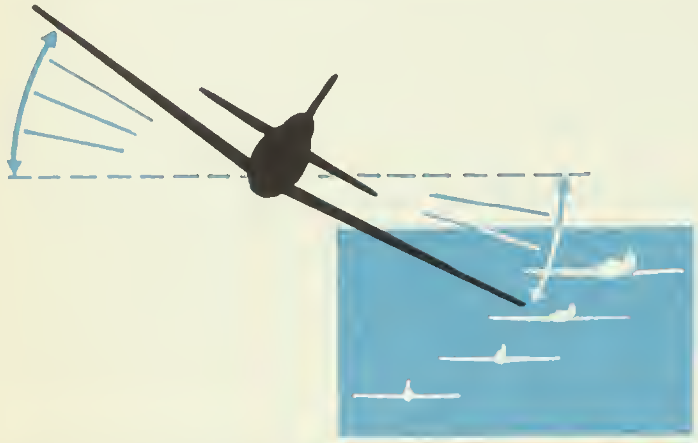
OPEN-UP FORMATION: Where applicable, this may be used to order a search formation.

SERIES OF SMALL DIVES AND/OR ZOOMS:



PREPARE TO LAND: An order to each pilot in the formation to prepare to land. In the absence of further signals the landing will be made in the normal landing formation of the unit, which should be predetermined. Any change in formation for landing will be ordered by supplemental signal by radio.

DIP RIGHT (LEFT) WING:



From any formation other than echelon go into echelon of flights to the right (left).

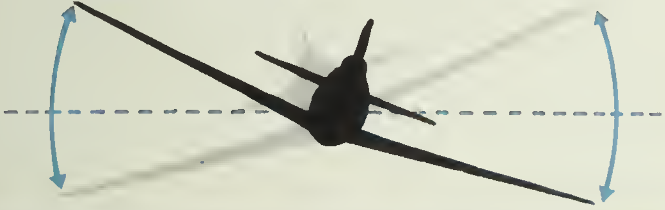
Being in an echelon of flights to the right (left), go into echelon of individual airplanes to the same side. Being in an echelon of individual airplanes, if wing is dipped on the side to which airplanes are echeloned, form echelon of flights to the same side. Being in an echelon of flights or individual airplanes, if wing is dipped on the side away from the echelonment, form same echelon) to the opposite side.

KEEP YOUR EYE ON YOUR COMMANDER

ROCK WINGS:

Slow, repeated, rocking motion of airplane about longitudinal axis, by gradual use of ailerons.

Wing movement to be slower and of greater amplitude than in "Flutter of ailerons."

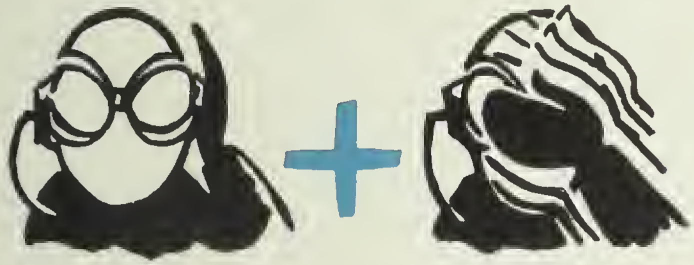


ROCK WINGS *Slowly*

ASSUME NORMAL FORMATION:

From any other formation, go into the normal closed-up formation for the unit concerned. This formation is to be prescribed in each group and/or squadron.

Hold hand to headset and then swing hand up and down in front of face several times, as in "cease firing."



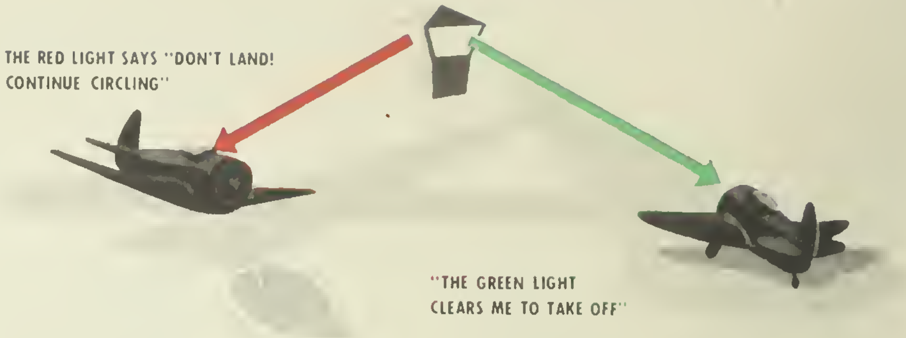
RADIO OUT OF COMMISSION:

When necessary or desirable this signal may be given by an occupant of the airplane other than the pilot.

These signals may be augmented as required by any group or larger unit or by separate squadron or flight. In such case, however, care will be taken to avoid confusion of added signals with those herein prescribed and the number of signals added will be kept to a minimum.

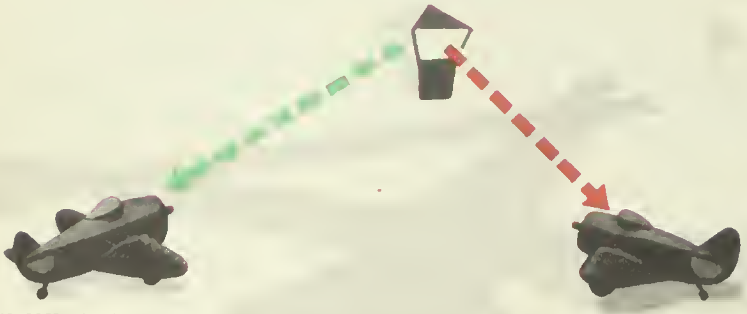
REFERENCE: AAF REGULATION 60-15 DATED JULY 9, 1942

TOWER LIGHT GUN SIGNALS



THE RED LIGHT SAYS "DON'T LAND! CONTINUE CIRCLING"

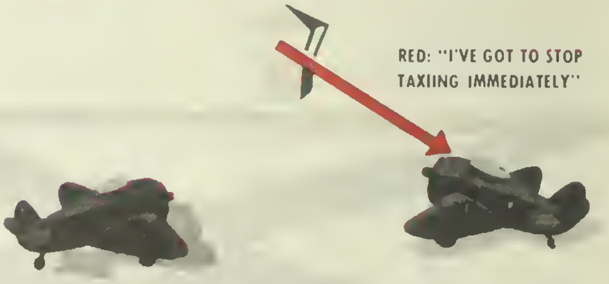
"THE GREEN LIGHT CLEARS ME TO TAKE OFF"



"FLASHING GREEN LIGHT MEANS I CAN CONTINUE TAXIING"

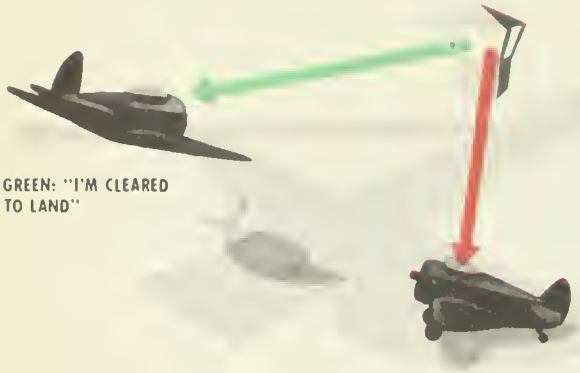
"FLASHING RED LIGHT TELLS ME TO RETURN TO THE LINE!"

PILOT ACKNOWLEDGES SIGNALS BY MOVING AILERONS OR RUDDER



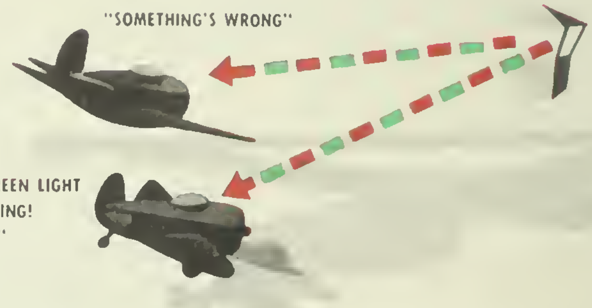
RED: "I'VE GOT TO STOP TAXIING IMMEDIATELY"

GREEN: "I'VE HAD THE GREEN LIGHT AND I'M TAKING OFF!"



GREEN: "I'M CLEARED TO LAND"

RED: "I'VE GOT TO HOLD-CLEAR OF THE RUNWAY"



"SOMETHING'S WRONG"

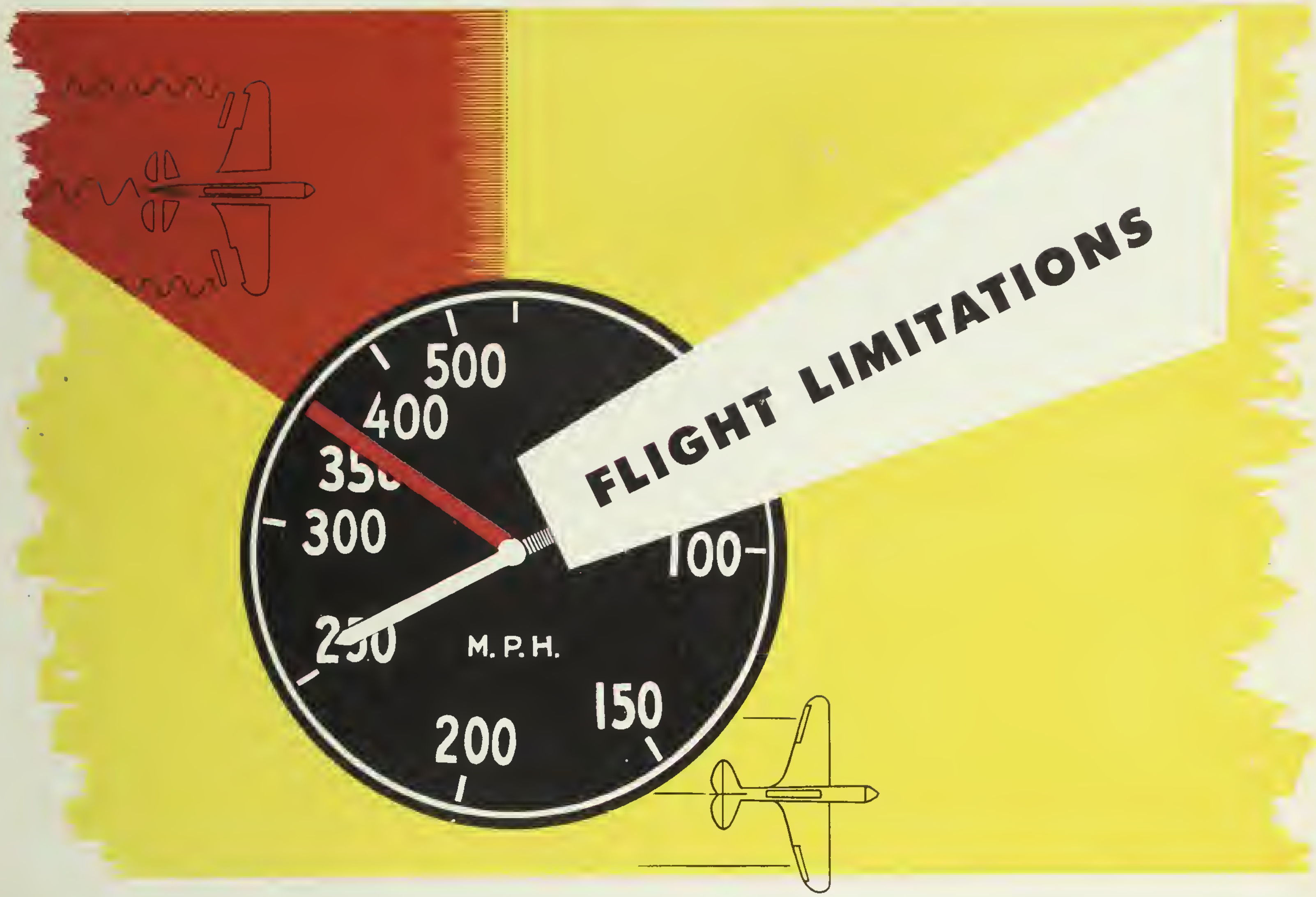
"FLASHING RED AND GREEN LIGHT IS AN EMERGENCY WARNING! I'D BETTER WATCH OUT!"

NIGHT AIRPLANE-TO-TOWER SIGNALS

TURN ON YOUR LANDING LIGHTS AND KEEP THEM ON, THIS MEANS: "I WANT TO LAND."

ONE FLASH OF YOUR LANDING LIGHTS MEANS: "I HAVE RECEIVED YOUR SIGNAL AND WILL COMPLY."

BLINKING LANDING LIGHTS MEAN: "TURN OFF FLOOD LIGHTS!" IF ON. "TURN ON FLOOD LIGHTS!" IF OFF



FLIGHT LIMITATIONS

Don't exceed the red line speed on your airspeed indicator. If you do, structural or control failure may result.

The structure and flight characteristics of any type of aircraft limit its performance. In actual flight tests these limits are carefully determined, then each type is redlined at a point within its safety limits.

The red line has a definite purpose. It represents what the airplane was built to do. When you exceed the red line, you are demanding more performance of the airplane than it was designed to accomplish.

You will find that the red line is much nearer to cruising speed on heavy bomber and cargo aircraft than on lighter fighter and attack aircraft. A heavy bomber was designed to carry heavy loads for great distances, to fly at high altitudes, and to defend itself against fighters and flack. It can withstand safely approximately 5 Gs when empty, but not more than 2 or 3 Gs when fully loaded.

A fighter normally is built to withstand up to 12 Gs before permanent deformation or structural failure results. Its primary functions entail high speed and great maneuverability.

Factors influencing flight limitations are:

1. Type of work to be done. (Bomber—Fighter).
2. Design of the airplane. G forces it can withstand without permanent deformation or structural failure.
3. Size and load-carrying capacity of the plane.
4. Point of compressibility. (PIF 2-21-1.)
5. Special equipment (external fuel tanks, bomb racks, rocket tubes, etc.)

Know Your Airplane

1. **Read all TOs and Pilot Operating Instructions that apply to your airplane.**
2. **Don't experiment with prohibited speeds or maneuvers** unless authorized to do so by competent authority for a specific purpose.
3. **Take it easy** in recovery from any unusual position or speed. Don't jerk or manhandle your airplane. No plane is built that can't be torn up by rough handling of controls, especially at high speeds or in unusual maneuvers.
4. **Use pressure, not movement** of the controls for smooth, uniform recovery.

Your airspeed indicator is your only indication of your true airspeed. Never forget or underestimate its importance. Use the table given here to figure True Airspeed from the Indicated Airspeed shown on your airspeed indicator:

Figuring True Airspeed

At 5,000 feet increase IAS by 7½% to get TAS
At 7,500 feet increase IAS by 10% to get TAS
At 10,000 feet increase IAS by 15% to get TAS
At 15,000 feet increase IAS by 25% to get TAS
At 20,000 feet increase IAS by 35% to get TAS
At 25,000 feet increase IAS by 50% to get TAS
At 30,000 feet increase IAS by 65% to get TAS
At 35,000 feet increase IAS by 80% to get TAS

Vibration and Flutter

If there is any flutter or unusual vibration in your airplane, reduce airspeed and engine speed to minimize it until you can land. In particular, any persistent oscillation in which relative motion can be observed between the wings and ailerons, or stabilizer and elevator, or fin and rudder, is likely to be dangerous.

Don't take off in an airplane if the engine is rough on ground run-up.

Small, high frequency vibrations existing over long periods of time may cause fatigue failures.

Factors likely to set up excessive vibrations in an airplane in use are:

1. Propeller—Unbalance, incorrect setting, improper mounting, etc.
2. Power Plant—Missing of one or more cylinders, improper adjustment, unsatisfactory mounting, etc.
3. Control Surfaces—Reduction in rigidity, loose hinge fittings, bearings, or balance weights, etc.
4. Control Systems—Excessive play in tab-control systems, insufficient tension in control cables, loose bearings, and attachments, etc.
5. Wings and Fuselage—Reduction in bending or torsional rigidity through damage, slack, or defects in the covering or truss systems.

Loading Airplanes

Use extreme care in loading airplanes. Additional loads, other than those normally carried in the plane, alter the balance and stability. In some airplanes so burdened, the response to the controls may be sluggish and recovery from spins difficult or impossible.

Conditions Governing Maneuvers Permitted

The permissible maneuvers and load factors for any airplane do not apply when the airplane is loaded in excess of its designed gross weight. **Never load your airplane in excess of its permissible gross-weight condition.**

OBSERVE ALL FLIGHT RESTRICTIONS

1. Don't exceed the red line.
2. Obey any special restrictions placed upon particular models by the proper authority.
3. Observe operating instructions published in compliance with Technical Order 00-10.
4. See information on Form 1A.
5. Read handbook of Operation and Flight Instructions published as a TO for each airplane.
6. Know all Technical Orders or notices affecting your airplane.

Stalls and Spins

STALLS

Airplanes with high wingloadings require considerable altitude to recover from a stall.

Using aileron to lift the dropping wing increases the stall and a spin may develop unless the airplane is inherently stable against spinning.

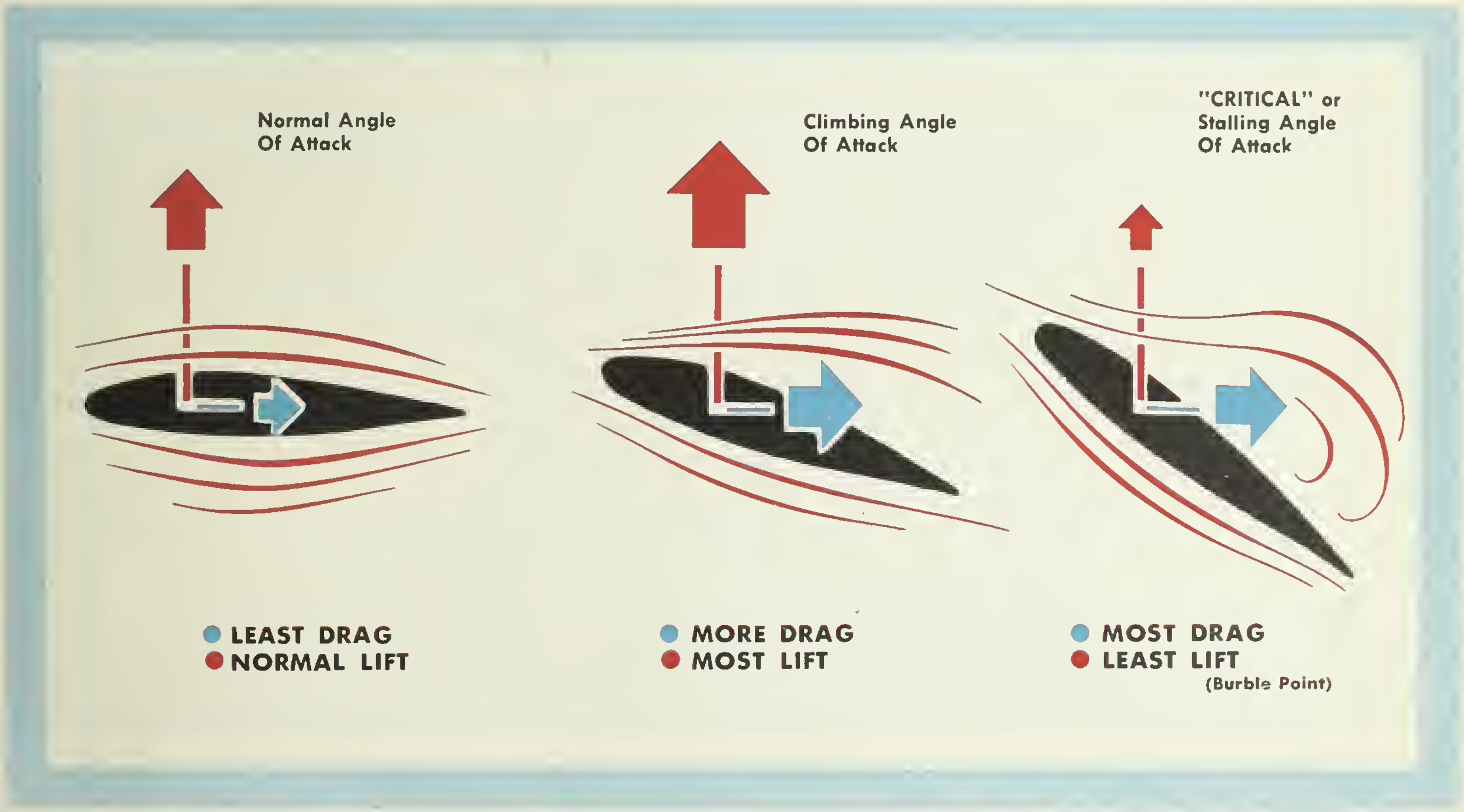
To correct stall, **reduce the angle of attack and get flying speed by diving.** The most dangerous feature is that so much altitude must be lost to regain control.

Most maneuvers, including banks, increase the effective gross weight of an airplane. **Be sure you have enough flying speed to provide for the increased stalling speed created by banks or other maneuvers which impose greater than normal loads on your plane.**

Don't make sloppy turns; skids at low speeds will stall your plane.

Don't make side-slip landings, particularly with flaps down. Flap shadow, or wake, is likely to blanket vertical surfaces at low speeds, and reduce rudder control.

Watch for warnings of an approaching stall.



AERODYNAMICS OF A STALL

HIGH-SPEED STALLS

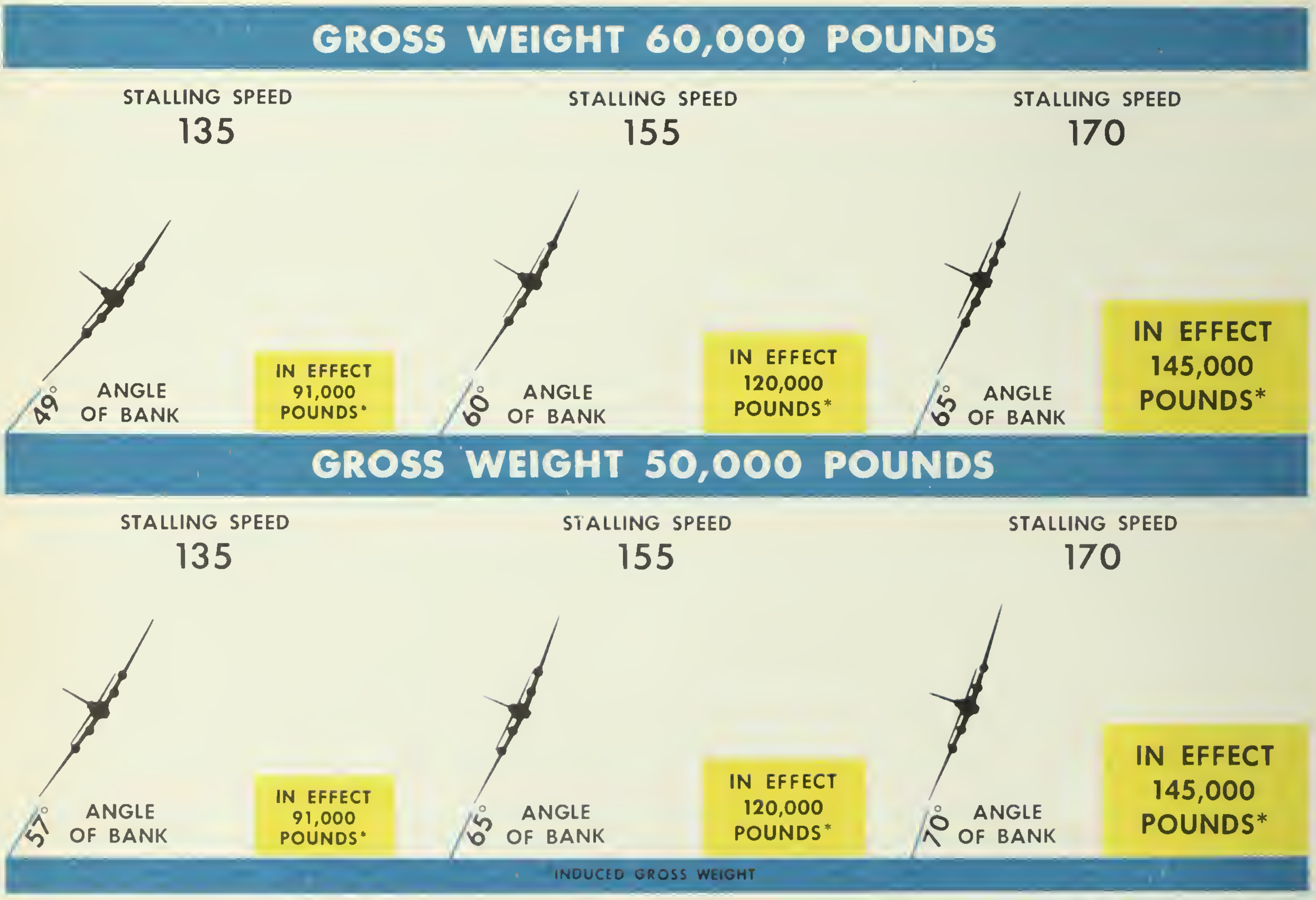
You know that as the gross weight of an airplane goes up the stalling speed increases. When an airplane is turning in a banked attitude, centrifugal force has the same effect as increasing the gross weight, and the stalling speed of the airplane is thereby raised.

1. For example, if a B-17G airplane weighing 60,000 pounds is turned in a 60° bank, the pilot is in effect flying an airplane weighing 120,000 pounds and the stalling speed has been raised to 155 IAS. A 60,000 pound B-17G can be stalled at normal cruising speed merely by entering a steep bank, but the stall thus encountered is not a normal stall. The speed and high induced gross weight may cause a violent stall which endangers the airplane's structure. Stalling the airplane in a banked attitude may throw it into an inverted attitude from which several thousand feet will be required for recovery.

2. To show the degree of bank at which a B-17G stalls at 60,000 and 50,000 pounds for 135 IAS, 155 IAS, and 170 IAS, see the charts below:

3. Note that for a particular IAS the induced gross weight at the stall point is the same for both gross weights. As the stalling IAS is raised the induced gross weight at the stall point increases rapidly. The maximum induced gross weight which can be sustained without permanent deformation to the wing structure is 148,000 pounds. This corresponds roughly to a stalled bank at an IAS of 172 mph for any gross weight.

INCREASED STALLING SPEED AND EFFECTIVE GROSS WEIGHT OF B17 AT VARIOUS ANGLES OF BANK



Degree of Bank	Percent Increase in Normal Stalling Speed	Approximate Stalling Speed Based on 100 mph Normal Stalling Speed
0°	0	100
10°	.5	101
20°	3.0	103
30°	7.0	107
40°	14.4	115
50°	25.0	125
60°	41.4	142
70°	71.0	171
80°	140	240
90°	Infinity	Infinity

The figures in the table show how banking an airplane with a stalling speed of 100 mph increases the stalling speed. The table may be used for any airplane by adding the percentage of increase in the second column to the known stalling speed of the airplane.

Note particularly the sharp increase in steep banks.

SPINS

There is no infallible method for recovery from spins. In general, apply full rudder against direction of rotation. Follow by full forward stick until rotation stops.

Move controls briskly to a position full against the spin. Don't move controls slowly or cautiously, for that may permit the spin to continue indefinitely.

Using the ailerons as an additional means of recovery is debatable. In general, hold the ailerons in a neutral position unless otherwise instructed in procedures for specific airplanes.

Precautions

Don't spin an airplane that is restricted against spinning. There are good reasons for the restriction.

Don't get excited. Mental confusion sometimes causes pilots to move controls opposite to intended procedure.

Don't get impatient. Give the controls at least five turns to take effect. Then, if still in the spin, and you have sufficient altitude place controls full with the spin and attempt recovery again by brisk control movement.

Bail out before it's too late. Fix in your mind the altitude at which you're going to bail out if you get into a spin. Never attempt to stay with any tactical airplane in a spin closer than 5000 feet to the ground.

Get plenty of altitude for recovery before starting an intentional spin in an airplane with doubtful spinning characteristics. Your plane will lose a great deal of altitude during recovery.

Caution

Complete any intentional spin in a tactical airplane at an altitude of at least 10,000 feet above the ground.

Factors Influencing Spin Recovery

Position of wheels. Generally, both spin and recovery are better with wheels up.

Ammunition loads in wings. Spin recovery usually is more sluggish with ammunition loads in wings. The effect is more noticeable on airplanes that normally spin with one wing tip well down; such a load may endanger recovery.

Using the throttle in an attempt to recover from a bad spin is effective at times. Use throttle for spin recovery only if normal recovery procedure is ineffective. Either short bursts or steady applied power may be necessary.

Technique

The following techniques apply to most airplanes. **However, you must learn the specific procedure that applies to your airplane.**

Usually, if you hold the ailerons neutral and the elevator and rudder controls all the way with the spin, the spin will be more steady. Also, moving the controls from one extreme to the other (against the spin) gives a snappier and more forceful reaction for recovery.

Generally, use rudder first, then elevators because:

1. Reversed rudder checks the rate of rotation and causes the nose to go down.
2. Blanketing of the rudder by the elevator is usually less, and rudder is more effective when the elevator is up.
3. Hold the stick back while you hold the rudder opposite to the spin. As you slow down the rate of the spin, your elevators become progressively more effective.
4. The comparative effectiveness of rudder and elevator during spin recovery varies greatly. The elevator may be a more positive control than the rudder. Even then, don't change the sequence of control movement unless specifically instructed.

The first few turns of a spin are a transition period from straight and level flight to the final steady spin. During this time recovery often grows progressively more difficult. When spinning a strange airplane, use this period for testing the ease of recovery at various stages of the spin. In the first trial, for example, attempt recovery after ¼ turn, and in succeeding trials, recover after ½, ¾, 1, 1½, 2, 3, etc., turns. Thus, you can learn the spinning characteristics more gradually.

Uncontrollable spins are not necessarily flat spins. In a flat spin the controls are probably less effective than in a steep (or normal) spin.

In general, an airplane spins differently in a right than in a left spin, because of rigging to overcome propeller torque and slipstream effects. An airplane may have satisfactory characteristics for a spin in one direction and unsatisfactory spin characteristics in the opposite direction.

Changes in weight and center-of-gravity position are likely to effect spinning characteristics. It is difficult to predict the effect of a definite center-of-gravity position on these characteristics.

Don't spin an airplane intentionally when the CG position is rear of normal. It is much more difficult, and sometimes impossible, to recover under this condition.

Caution

Check your position in the cockpit before takeoff. Be sure that you get full travel and can apply full force all the way on all controls.

Remember these Tips

1. Be sure you can get full control movement and can apply force on the controls.
2. Don't get excited.
3. Don't be impatient. Leave the controls in recovery position long enough.
4. Fix in your mind beforehand the altitude at which you must bail out.
5. Get plenty of altitude before starting an intentional spin in tactical airplanes.
6. Don't spin with a rear of normal CG.
7. Don't spin an airplane restricted against spins.

REFERENCE: AAF Memorandum 62-4.

COMPRESSIBILITY

When a fighter airplane approaches the speed of sound, it reaches a point where it loses its efficiency. Some or all of the following things happen:

1. Lift characteristics will be reduced or entirely destroyed.
2. Intense drag develops.
3. Stability and control characteristics change.
4. The tail buffets; the airplane may develop uncontrollable pitching and porpoising; it may develop uncontrollable rolling and yawing; or it may have a combination of these effects.
5. Severe vibration of the ailerons or of the entire plane may develop.
6. Trim changes in almost every case.

These are known as compressibility effects. The point at which an airplane enters compressibility varies with different models of aircraft; it varies on the airspeed indicator with changes of altitude, just as the speed of sound varies at different altitudes.

Compressibility is caused by a change in the physical behavior of air as it passes over any curved surface which is travelling at high speeds through the air mass. The continuity of the airflow breaks down; compression or shock waves develop on the wings or other surfaces and ahead of the airfoils; the air seems to split apart, shooting off at a tangent on both the upper and lower surfaces.

Mach Number

The Mach (pronounced mock) number is the speed of an airplane divided by the speed of sound. The critical Mach number is the point at which a given airplane goes into compressibility. Because of design limitations, a plane actually goes into compressibility **before it reaches the speed of sound.** With some airplanes this point is reached at a speed 65% that of sound, others as high as 80%, depending upon the design of the model. Know the limiting speeds or critical Mach number of your plane before you attempt high speed maneuvers.

Airspeed and Speed of Sound

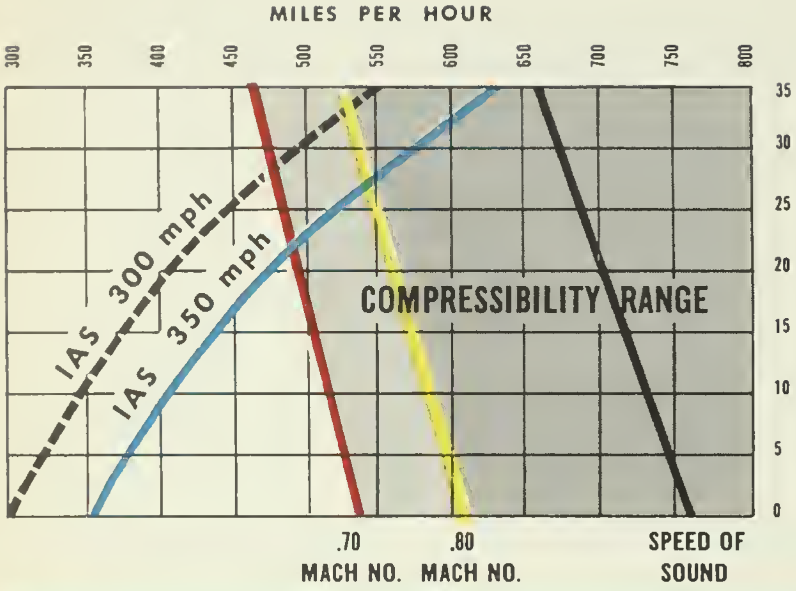
True airspeed and indicated airspeed are identical at sea level. TAS is greater than that shown on the airspeed indicator as you reach higher altitudes. The higher you climb, the greater the discrepancy, until at 35,000 feet when your airspeed indicator registers 300 mph you're actually travelling more than 500 mph true airspeed.

The speed of sound is 760 mph at sea level and gradually drops to 660 mph at 35,000 feet. Your plane goes into compressibility when the percentage of TAS to speed of sound at any given altitude exceeds the critical Mach number.

Avoid Speeds Within Compressibility Range

1. Know the critical Mach number or limiting airspeeds of your plane. Know TAS and IAS ratios at approximate altitudes where you intend to carry out maneuvers. Know the speed of sound at those altitudes.
2. Never attempt high-speed dives with external tanks until you are familiar with their effect.
3. Avoid violent use of ailerons in high-speed maneuvers and dives.
4. Keep rudder and elevator trim in relative position for level flight. Use trim tabs only if necessary. Make minute adjustments in trim only with great caution and, above all, observe the specific operating procedures for your airplane.
5. Never roll into a vertical dive above 30,000 feet, when it's possible to avoid it.
6. Use controls gently at high speeds and high altitudes. Do not attempt to recover from dives too quickly. Rough handling of the controls may cause entry into the compressibility range much more easily above 20,000 feet than below it.
7. Do not have a routine procedure for all fighter types as a group. Each type has its own peculiar high-speed dive and compressibility effects.

Note! **Observe the Placard of Limiting Airspeeds posted in the cockpit of your airplane.**



Compressibility

The chart shows how easy it is to get into compressibility at high altitudes, with your airspeed indicator still well under the red line.

For example, if your airplane has a Mach number of .70 it will enter compressibility at 22,000 feet if the IAS is 350 mph (intersection of blue and red lines). With an IAS of 300 mph it would enter compressibility at 28,000 feet (dotted line and red line). Likewise shown are the points where it would enter compressibility if it had a Mach number of .80.

Vertical Dive Recovery

Don't dive too close to the ground. Modern fighter airplanes require plenty of altitude for safe recovery from high-speed dives. Not only do you lose altitude rapidly; you must have a lot of air under you if you black out by exceeding the acceleration you can withstand in recovery.

The average pilot cannot withstand more than 4 G acceleration for periods (10 to 20 seconds) required for pullouts from high-speed vertical dives without blacking out. Accelerations higher than 4 G for extended periods will result in blacking out and loss of consciousness. **Don't get into a diving position which will require more than 4 G acceleration for safe recovery.** (See PIF 4-3-1.)

Unless you have an instrument showing acceleration, the best way to judge it is by the pressure on the seat of your pants. If you have ever blacked out, recall that pressure.

Minimum Safe Altitudes

The chart on the opposite page shows the minimum safe altitude for recovery from vertical dives at various speeds, altitudes, and accelerations. These curves are based upon certain idealized conditions which make them applicable to all airplanes. However, they are not strictly accurate in all cases. For this reason, a safety factor of 25% is included.

The altitude required for recovery from a vertical dive at constant acceleration is a function of true speed and not indicated speed. Different losses in altitude occur at different altitudes for the same indicated airspeed. This accounts for the difference in scales for the different altitudes.

Using the Chart on Next Page

The curves are plotted in terms of **indicated airspeeds** at several altitudes to facilitate their use in conjunction with the airspeed indicator.

Remember altimeter readings usually lag several hundred feet behind the actual altitude in dives.

The curves for accelerations higher than 4 G are given only to show the effect of variations in accelerations.

A chart, showing altitude required for recovery with an acceleration of 4 G, will usually be included in the operating instructions of all airplanes for which vertical dives are not prohibited.

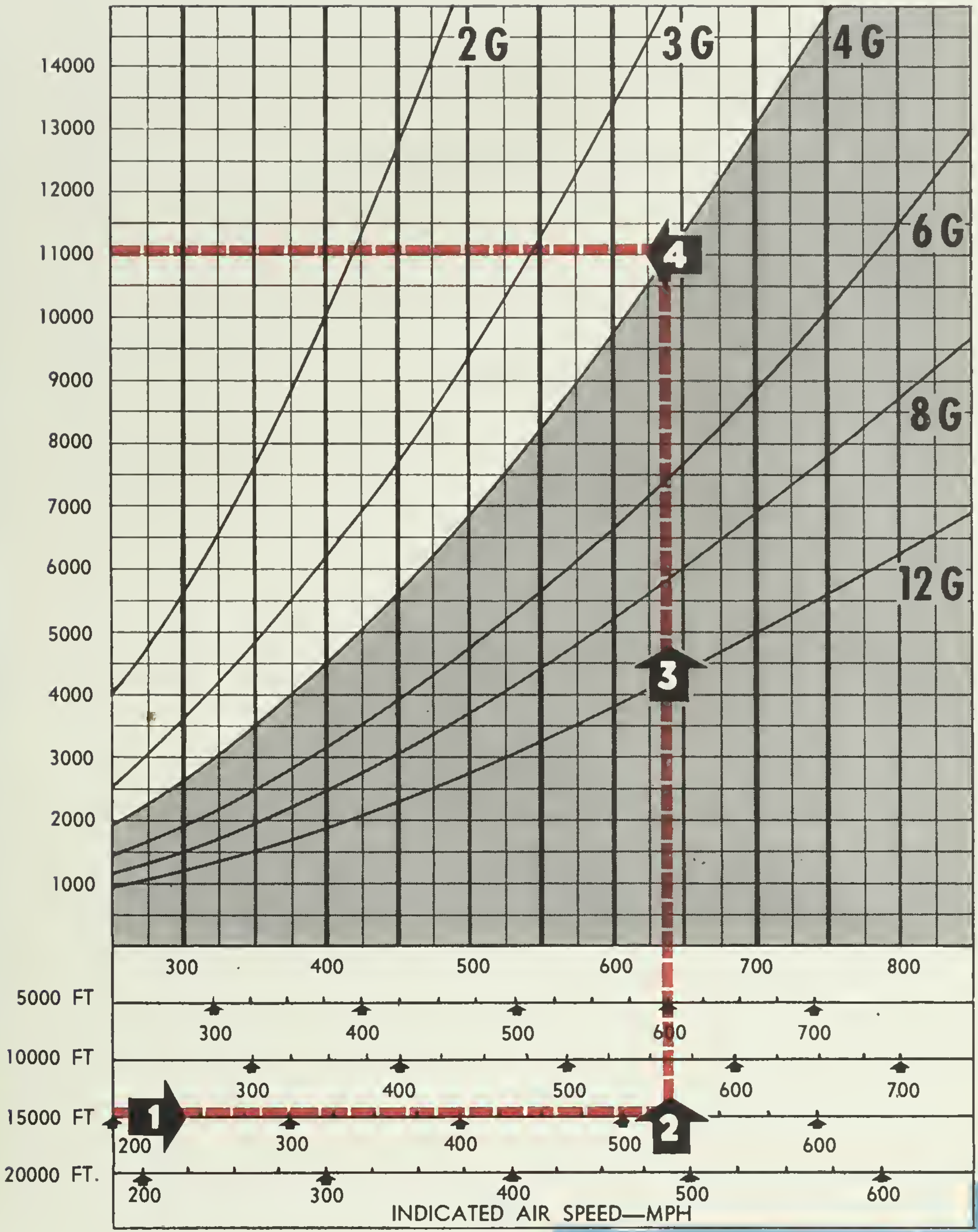
Caution

When diving at high speeds from high altitudes, avoid abrupt pullouts. Make special efforts to avoid them by proper handling of your trim tabs, control stick, and rudder. Such pullouts place dangerous strains on your airplane and your own body.

In high-speed dives bring your trim tabs back to approximately the neutral position when you reach an altitude of about 20,000 feet. Excessive use of trim tabs in these dives causes overload on the plane structure in excess of its designed load limits when you reach the lower altitudes where they become effective.

MINIMUM SAFE ALTITUDE REQUIRED FOR PULL-OUT FROM A VERTICAL DIVE

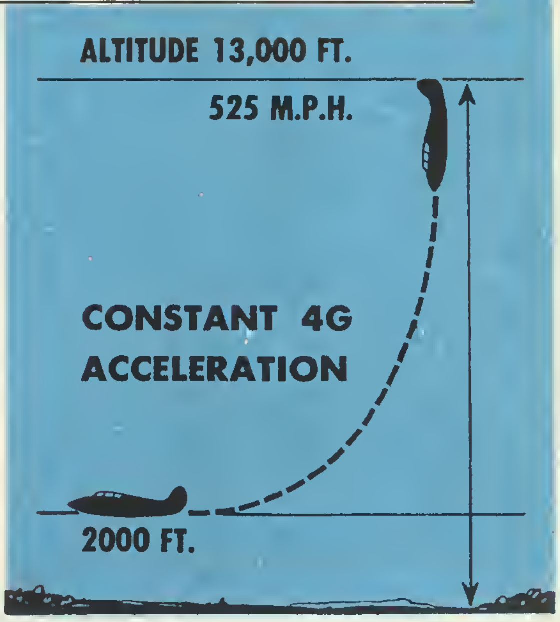
ALTITUDE AT START OF PULL-OUT

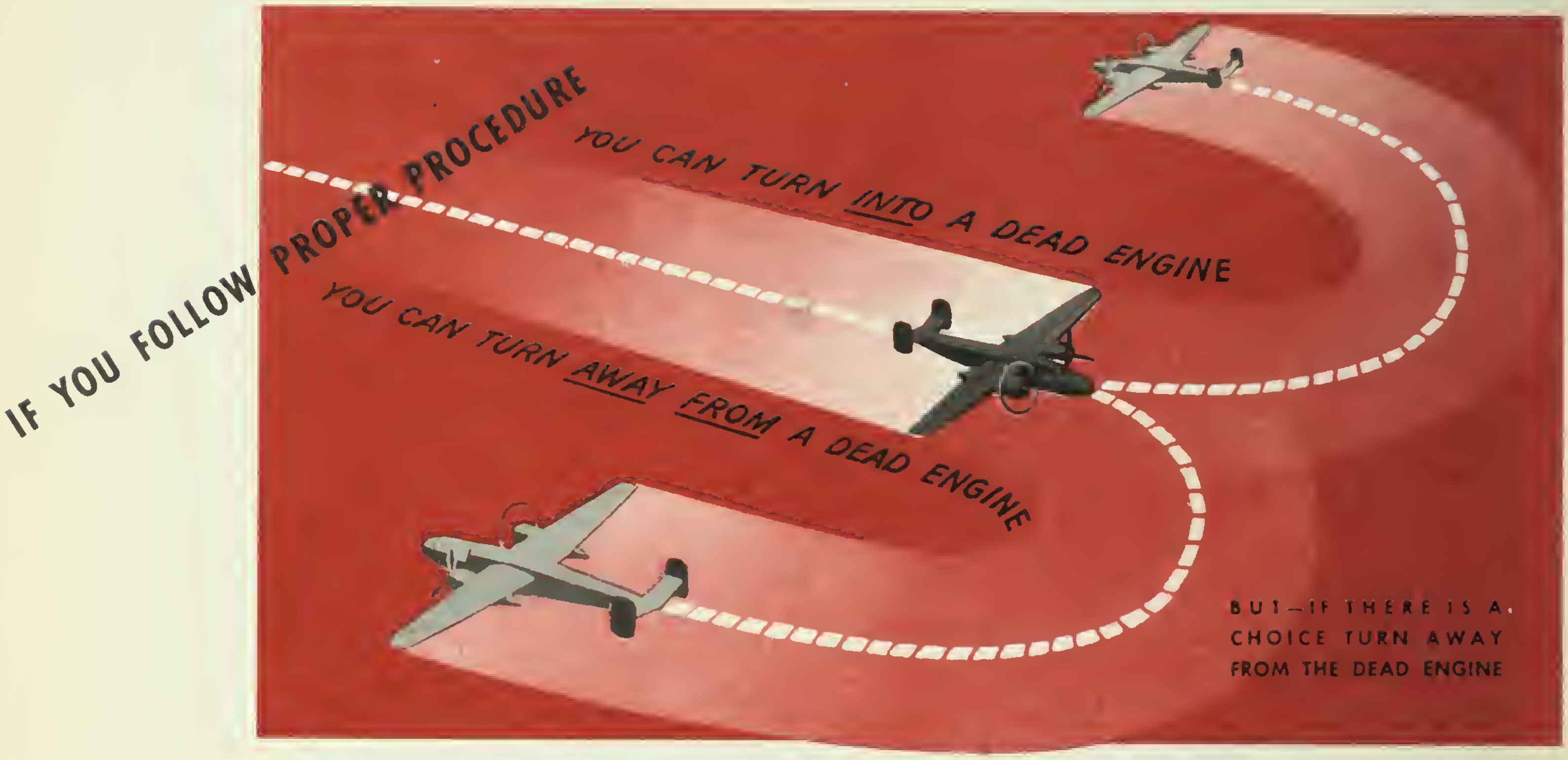


PROBLEM Find altitude remaining after making a pull-out from a vertical dive, starting the pull-out at 13,000 feet and 525 mph IAS and maintaining a constant acceleration of 4 G.

SOLUTION 1 13,000 feet is nearest to the 15,000 feet altitude line. 2 Mark the 525 mph point on the 15,000 feet altitude line. 3 Sight up the vertical lines to point on 4 G line which is directly above point obtained in (2). 4 Sight back horizontally to scale on left to find minimum safe altitude required for pull-out (approximately 11,000 feet). 5 Subtract this figure from the 13,000 feet at which pull-out was started to find altitude remaining.

13,000 feet
11,000
altitude remaining = 2,000 feet




IF YOU FOLLOW PROPER PROCEDURE
YOU CAN TURN INTO A DEAD ENGINE
YOU CAN TURN AWAY FROM A DEAD ENGINE
BUT—IF THERE IS A CHOICE TURN AWAY FROM THE DEAD ENGINE

ENGINE FAILURE ON MULTI-ENGINE AIRCRAFT

The loss of one engine in multi-engine aircraft is not serious if you will remember to do four things immediately. In sequence, they are:

1. Establish necessary airspeed and directional control. (Trim as necessary.)
2. Increase power (but don't exceed engine operating limits).
3. Reduce drag.
4. Reduce fire hazard.

Details of applying this procedure differ widely for various airplanes. You must consult the T. O. and Pilot Training Manual for your particular plane. See these instructions also regarding engine failure at takeoff.

Turns with One Dead Engine

First and most important: If in an emergency situation you have a choice of which way to turn, make your turns away from the dead engine. However, once you have established necessary airspeed and directional control (and this cannot be emphasized too strongly as the first step) there should be no reason why you cannot make a turn toward the dead engine. It is a logical procedure, if you know how to do it correctly.

Failure to realize this has probably given rise to the old superstition that turns into a dead engine are disastrous. That belief is one of the commonest fallacies of hangar flying. The sooner you realize it is not true the safer you'll be.

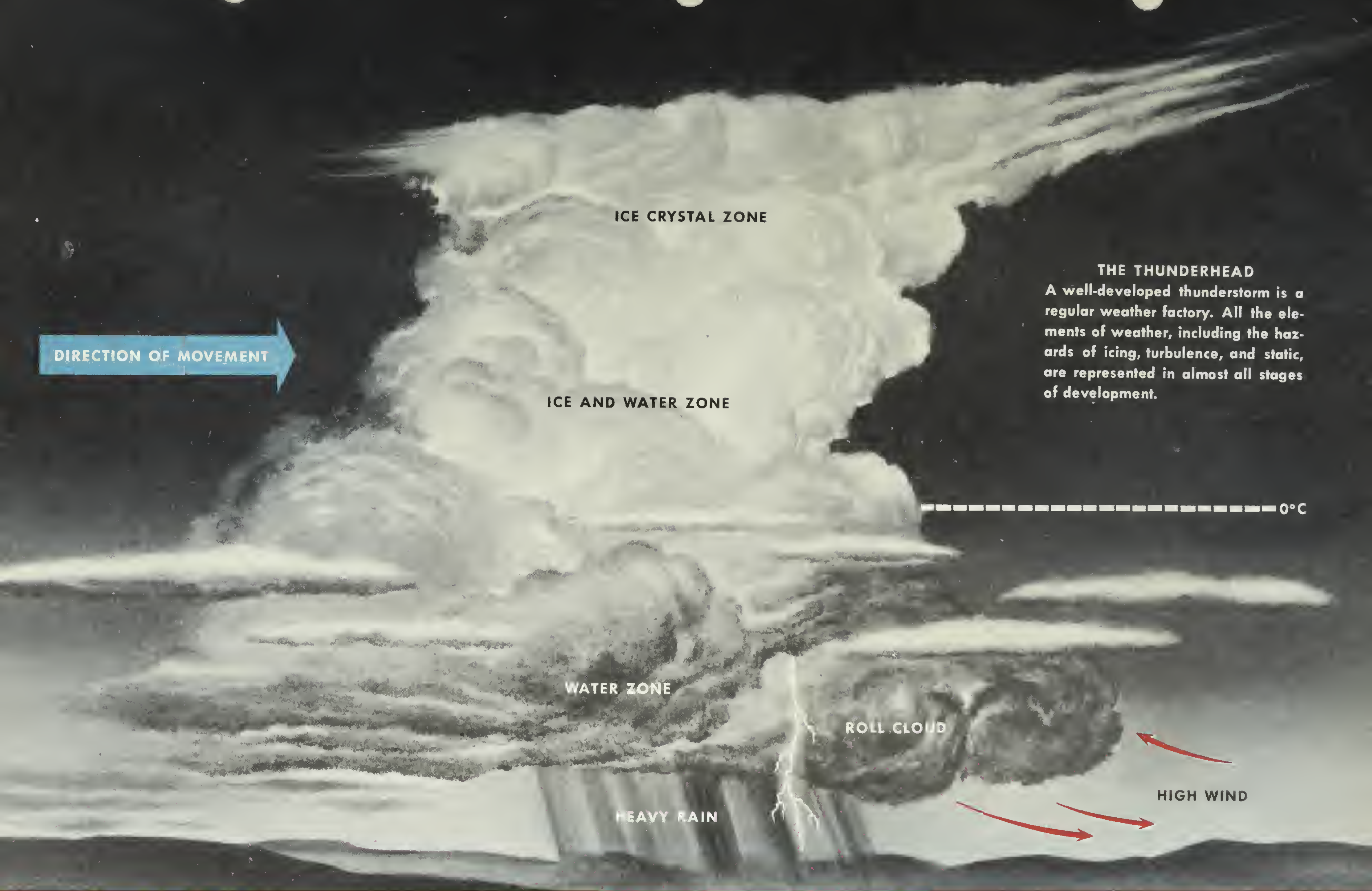
If you can make a smoothly coordinated turn into a live engine, or engines, you can turn into a dead engine just as easily if you observe the same rules exactly. Remember:

1. Holding constant the airspeed prescribed (or greater) for your airplane with one engine not operating is the most important factor in making turns. You must trim the airplane for this prescribed speed before attempting the turn.
2. As long as airspeed is constant the thrust of the live engine, or engines, is balanced by the effect of the trimmed rudder.
3. In turns there is always increased wingloading. Without additional power from the good engine, or engines, you will have to sacrifice some altitude in order to maintain airspeed.

Warning

Avoid sudden and violent applications of power while making turns with one dead engine. Such action requires compensating change in trim, and results in an uncoordinated turn and possible loss of control over the airplane.

Don't attempt any turn without proper trim.



THE THUNDERHEAD

A well-developed thunderstorm is a regular weather factory. All the elements of weather, including the hazards of icing, turbulence, and static, are represented in almost all stages of development.

SECTION 3 WEATHER FLYING

WEATHER PLANNING

Weather is one of the most important factors governing any flight. This section does not teach meteorology, nor does it attempt to solve flight problems for you. It outlines the facilities provided to help you work out your problems, tells you how best to use these facilities, and describes those elements of weather which, if not treated with respect, become hazards to safe flight.

Learn all you can about the facilities which exist to help you both in flight planning and in flying.

Know how to make intelligent use of the information obtained from the weather service.

Plan your flight carefully before you take off. Use your information and follow your flight plan.

Finally, make the most of your flight instruments; they are valuable allies in flight at any time.

Weather Service

The weather station is staffed by specialists, experienced in interpreting observations and in predicting weather trends. Although not usually pilots themselves, these experts appreciate your flight problems. They prepare the information you need to conduct your mission efficiently and with as little mental and physical discomfort as possible.

They receive the latest reports from AAF weather stations, U.S. Weather Bureau stations, and other agencies which, together, blanket the country. Their job is to interpret these reports and all other weather data, and to forecast probable future trends.

The forecaster is an adviser. He is not a clearance authority. It is your responsibility to get all the information you need from the weather office before you file your flight plan. Supply the forecaster with certain facts he needs to give an effective analysis: destination, tentative route (airways or direct), available gas supply, cruising speed, best altitude according to equipment, and any other information which may have a bearing upon the mission. Some of that information is entered on your Form 23, but only you know the capabilities of your airplane and your own limitations. The forecaster is there to advise you, but he can't advise blindly.

Importance of Weather in Flight Planning

The type of flight plan you must file depends upon the weather both existing and forecast. Under most conditions a CFR flight plan is sufficient. With others, you need an IFR flight plan to clear the field. Weather is the primary factor in determining route, altitude, distance to first stop, load, and—in extreme cases—whether you go or stay on the ground.

Most standard military equipment is well adapted to weather flying, but some airplanes cannot be flown under instrument conditions. No equipment has yet been designed to eliminate the need for careful consideration of all the weather conditions you are likely to encounter.

Successful navigation depends primarily upon having the latest accurate and complete information about conditions en route and at your destination. A forecast of wind direction and velocity at flight altitude is necessary for you to plan headings and groundspeeds. Conditions of icing and turbulence help determine flight altitude.

Study the conditions existing on your route.

Consider forecast conditions you will encounter. Then plan your flight accordingly.

Weather Station Facilities

Every AAF weather station provides the following facilities to help you in planning your flights:

Weather maps (synoptic charts)—every 6 hours.
Services of rated forecasters—continuous.
Teletype weather forecasts—every 6 hours.
Teletype weather reports—hourly.

Winds aloft charts—every 6 hours.

Adiabats (atmospheric soundings) — every 12 hours.

These are only a few of the facilities in the typical station, but they are of most immediate use to you.

Standard Procedure

You must have some system for planning your flight to get the most value out of the weather station. To obtain a comprehensive picture of the weather, both existing and forecast:

1. **Study the weather maps,** as a group. Notice what conditions prevailed at the time of the latest map. Compare the maps so that you can visualize general trends.

2. **Read the written forecasts** covering the route you intend to fly.

3. **Check the sequences (teletype weather reports)** for existing weather and most recent trends with the forecaster.

4. **Now, study the weather aloft** with the forecaster, using the upper air soundings.

5. **Obtain a winds aloft forecast** giving winds to be anticipated for the time of the flight.

6. **Finally, balance all factors** that influence your flight. Consider the weather maps, forecasts, sequences, weather aloft, and winds aloft. With the forecaster's help, choose a flight path that will give you the greatest advantage, considering all factors.

If you expect to fly on instruments, select sure alternate landing fields.

If the weather is CAVU you don't need to make a detailed study, but be sure of the weather before you file your flight plan; don't jump to conclusions.

The weather situation itself determines the amount of time you need to spend on each step. But check each facility to be sure of the weather picture every time you plan a flight. Then you'll know what to expect. **Remember, in any flight, there's no substitute for good judgment.**

WEATHER MAPS

Weather maps give you the background for planning your flight. Use them to get a general picture of the weather over the entire country for the preceding 24 to 30 hours. The maps clarify the overall weather picture by indicating the movement of weather in the area through which you intend to fly.

Observing the weather maps as a group, notice:

Classification of air masses—a lead to the flight conditions to expect.

Movement of high and low pressure areas.

Fronts and the weather associated with them—the maps together give the past speed of the fronts.

Thunderstorm areas—possible caution areas.

Air mass weather—where no fronts are involved.

Check the Map Time

Conditions shown on weather maps are those existing at the time the observations were made. The latest map in the station display is an analysis of observations made at least 3 hours before. All observations on the maps are made at the same time, four times daily:

0030Z 0630Z 1230Z 1830Z

Z is Greenwich Mean Time. To convert Z Time to local time:

Subtract 4 hours to get EWT.

Subtract 5 hours to get CWT.

Subtract 6 hours to get MWT.

Subtract 7 hours to get PWT.

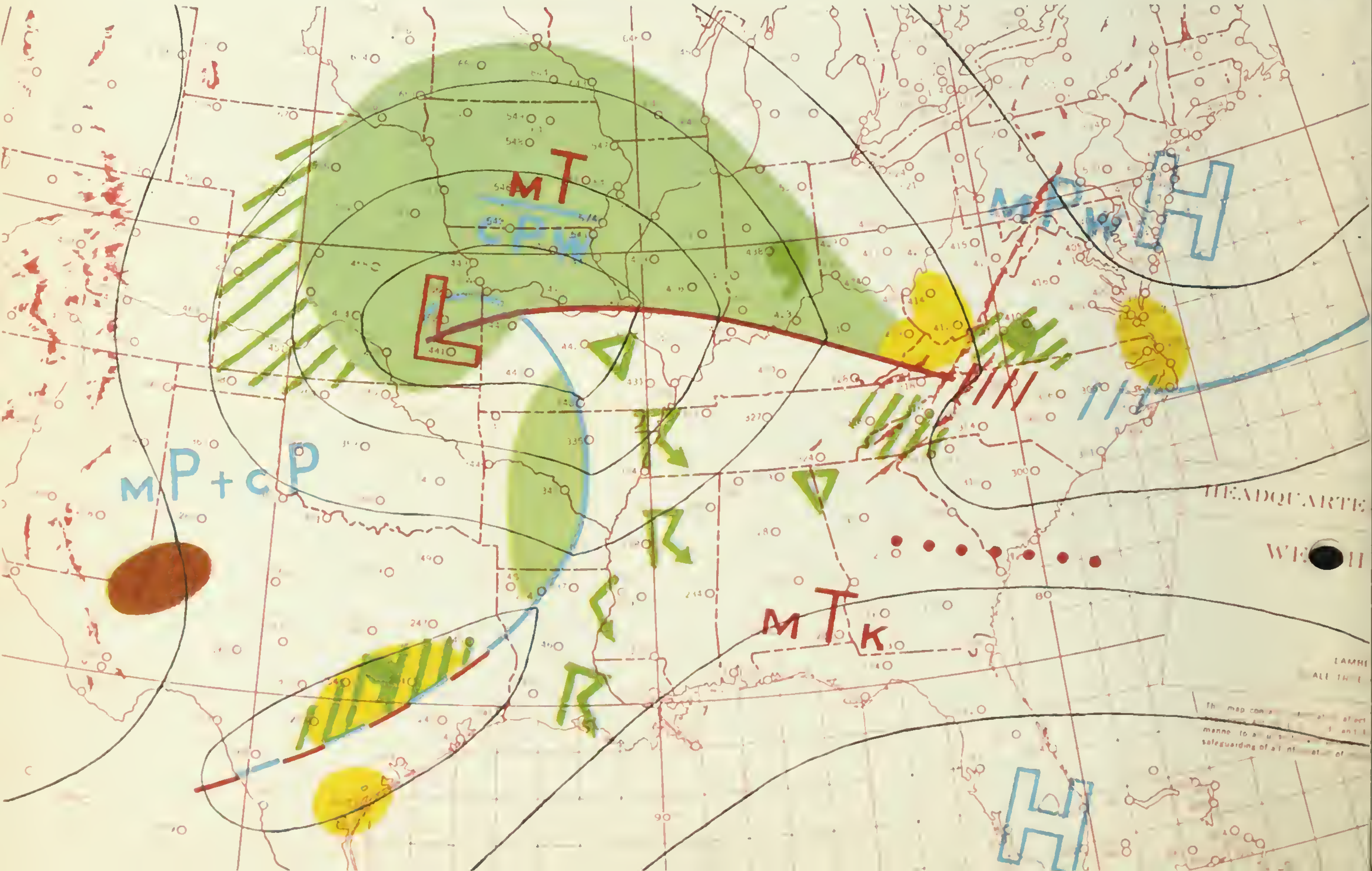
Station Circle

The station circle contains information which the forecaster uses to analyze the weather map.

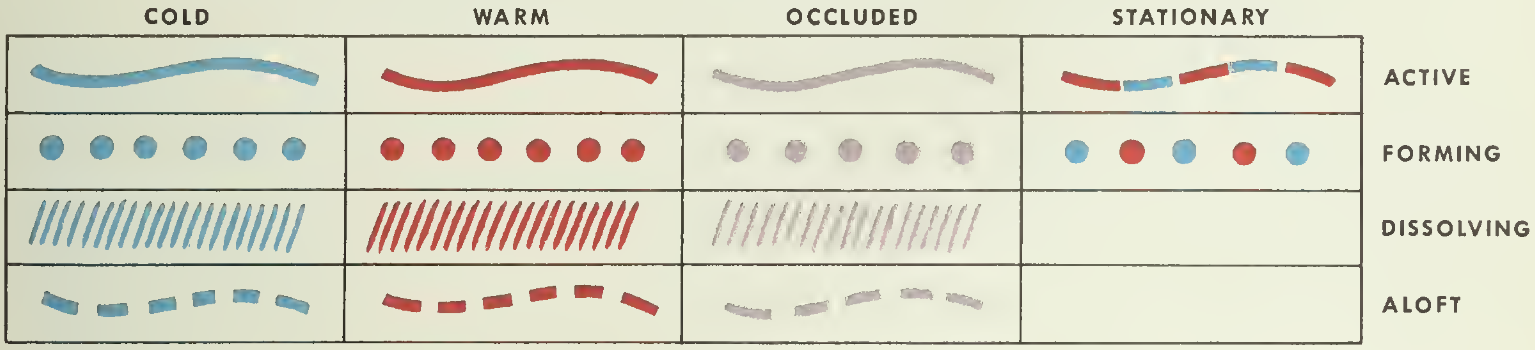
An observer plots teletyped information around the station circles in code; the forecaster then makes his final analysis on the map from this information.

When you study weather maps, the information contained in the station circles already is more than 3 hours old and is of little use to you. **For this** reason, completed station circles are not shown on the map illustrated.

Use the sequences for latest reports of ceilings, visibilities, and other weather information.



Fronts



Air Masses

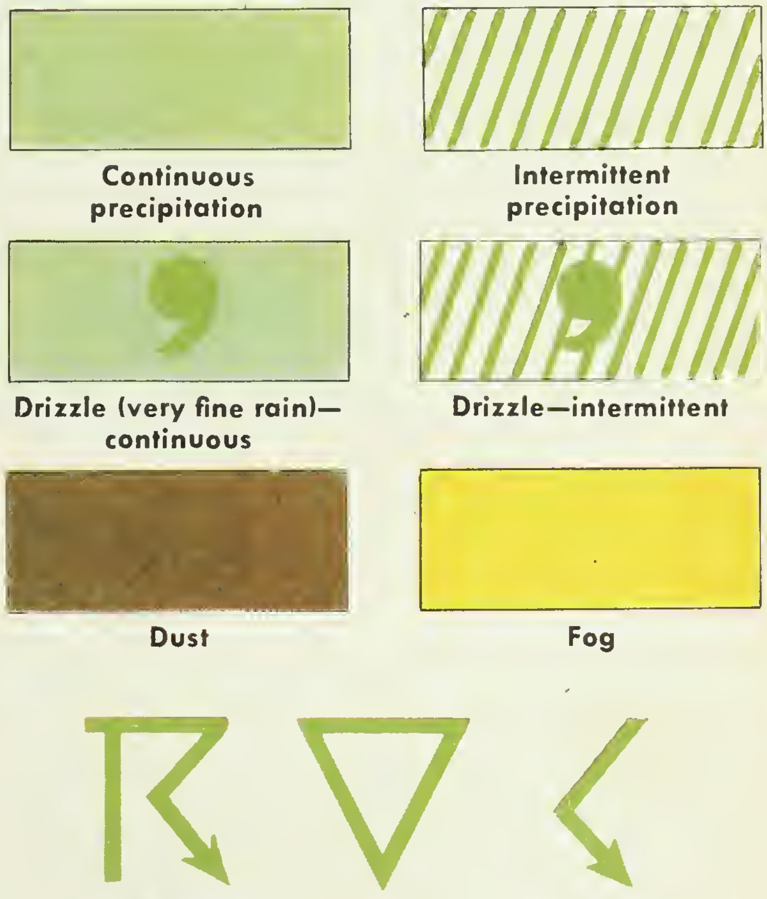
Color determined by P or T

mm	Moist air
cc	Dry air
P	Relatively cold air
T	Relatively warm air
ww	Stable (smooth) at surface
kk	Unstable (rough) at surface
$\frac{\text{mT}}{\text{cPw}}$	Moist hot air over dry cold stable air
mP+cP	A mixture of moist and dry cold air
cP→mT	Dry cold air changing to moist hot air
cPw	Dry cold air mass, stable at surface—a good situation for ground fog in early morning. Likely to change to cPk in afternoon.
cPk	Dry cold air mass, unstable at surface—CAVU
mPw	Moist cold air mass, stable at surface. Causes large areas low cloudiness, poor visibility in northwestern and northeastern coastal regions, particularly in winter. Far inland acts like cPw.
mPk	Moist cold air mass unstable at surface. Showers and cumulus clouds, particularly in summer. Rough icy weather over coastal mountains in fall and spring.
mTw	Moist hot air mass stable at surface. Large areas with low cloudiness and poor visibility.
mTk	Moist hot air mass, unstable at surface. Cumulus cloudiness, possible thunderstorms in afternoon.
cTw	Smooth—CAVU
cTk	Rough—CAVU

Pressure Centers

H	High pressure center—winds blow clockwise around the center.
L	Low pressure center—winds blow counterclockwise around the center.

Weather



FORECASTS AND SEQUENCES

Weather Bureau (CAA) and Army forecasts differ in one important respect. Army forecasts are tailor-made to meet the requirements at a particular field. Weather Bureau regional and terminal forecasts are teletyped reports intended primarily for routine airways flight; they are identical in all stations receiving them.

Compare both types when planning your flight. They should agree in their fundamentals. Both points of view are important. Their chief value to you is their explanation of the weather map.

Go over the forecasts with your station forecaster. He has even more recent information that may affect your flight.

Army Forecasts

Army forecasts are prepared by highly trained technicians four times daily. Each forecast is for a period of 24 hours to come. All of the weather information received at a station is used as a basis for the forecasts.

Army forecasts contain routine information and stress special conditions necessary to the mission of a particular base. The only abbreviations used are familiar ones, such as MI, FT, and MSL.

Routine elements of Army forecasts are:

A general discussion (synopsis) of the overall weather situation in the area.

A specific forecast of ceilings, visibilities, winds (surface and aloft), thunderstorms, and times of occurrence of expected major weather changes, such as passage of fronts.

Further outlook beyond the forecast period.

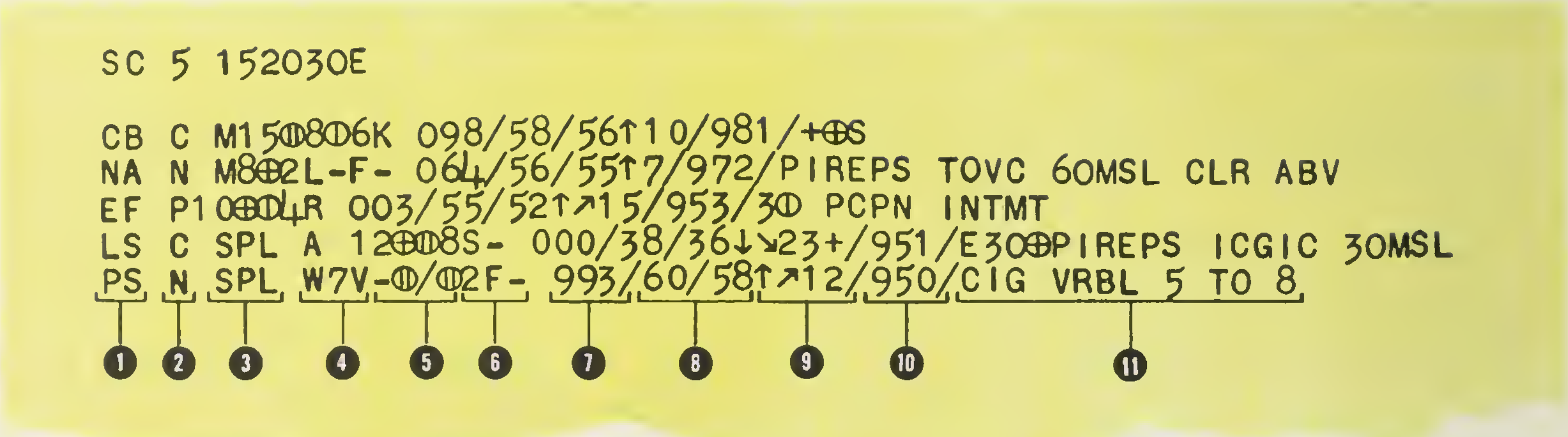
Hourly Teletype Reports

Hourly teletype reports (sequences) are the latest ground observations taken at specific stations. They are teletyped hourly on the half hour, in sequence, to your weather station. They contain the most recent actual weather available.

Use them as a check of the weather trends which the maps and forecasts indicate. With them, the forecaster can explain how the weather picture is developing.

Know the meanings of the symbols and the order in which they appear on the report. It saves you time in planning your flight.

Here is a portion of the sequence sent out on Circuit 5 (SC 5) on the fifteenth of the month, at 8:30 p.m. EWT (152030E):



```
SC 5 152030E

CB C M15⦶8⦶6K 098/58/56↑10/981/+⊕S
NA N M8⊕2L-F- 064/56/55↑7/972/PIREPS TOVC 60MSL CLR ABV
EF P10⊕⦶4R 003/55/52↑↗15/953/3⦶ PCPN INTMT
LS C SPL A 12⊕⦶8S- 000/38/36↓↘23+/951/E30⊕PIREPS ICGIC 30MSL
PS N SPL W7V-⦶/⦶2F- 993/60/58↑↗12/950/CIG VRBL 5 TO 8
```

1. Station call letters

2. Classification of report (only at specifically designated control airports):

C—ceiling above 1000 feet and visibility above 3 miles.

N—ceiling below 1000 feet or visibility below 3 miles.

3. Type of report:

SPL—A special report is so labeled whenever significant weather changes have taken place since the last report. Reports sent singly, out of sequence, are labeled like this:

SPL—152038C.—Figures are the date-time group. War time will be used for the duration.

4. Ceiling:

Ceiling figures are in hundreds of feet, preceded by a single letter:

M	measured by ceiling light
E	estimated
W	indefinite ceiling
P	precipitation ceiling
B	measured by balloon
A	reported from aircraft

The letter V following a ceiling or visibility figure indicates a varying condition.

The ceiling figure refers to the lowest cloud layer which is overcast or broken.

5. Sky condition:

The cloud layers visible from the ground are reported by symbols:

O	Clear
⦶	Scattered clouds
⦷	Broken clouds
⊕	Overcast

⦷/ A slant following a sky symbol means that the cloud layer is higher than 10,000 feet above the ground.

6. Visibility, weather, and obstructions to vision:

The visibility is reported in miles and fractions of miles from 0 to 9. The absence of a visibility figure is interpreted as **visibility unrestricted.**

	Weather		**Obstructions to vision**
R	Rain	F--	Damp haze
RQ	Rain squalls	F	Fog
RW	Rain showers	GF	Ground fog
T	Thunderstorm	IF	Ice fog
S	Snow	H	Hazy
SQ	Snow squalls	K	Smoke
SW	Snow showers	D	Dust
L	Drizzle	BS	Blowing snow
ZR	Freezing rain	GS	Drifting snow
ZL	Freezing drizzle	BD	Blowing dust
E	Sleet	BN	Blowing sand
A	Hail		
AP	Small hail		

The intensity is shown as follows:

(−) light; (no sign) moderate; (+) heavy.

7. Barometric pressure:

Don't confuse barometric pressure with the altimeter setting. There is no relationship between them. The barometric pressure, reported in millibars, has been corrected for the mean temperature during the preceding 12 hours and cannot be converted to altimeter setting.

8. Temperature/dewpoint, reported in degrees Fahrenheit:

The difference between the two figures is a rough measure of both relative humidity and the possibility of fog formation. The smaller the difference, the greater the humidity and the possibility of fog.

9. Wind direction and velocity:

Direction is reported from 16 points of the compass, arrows flying with the wind. Velocity is reported in whole miles per hour. Gustiness, if present, is indicated by a minus sign (−) for fresh gusts with peak velocity of less than 25 mph; a plus sign (+) for strong gusts with peak velocity of more than 25 mph. The letter C indicates calm, no wind.

10. Altimeter setting:

Reported in units and hundredths of inches of mercury. If the first figure is 9, read 29. inches; if the first figure is 0, read 30. inches.

11. Remarks:

Additional information in standard symbols and abbreviations is transmitted when appropriate. Here you find the height of cloud layers when this is not given in the body of the report. Pay special attention to any remarks preceded by PIREPS, since these are reports from aircraft. Special non-weather data is added, concerning field conditions and facilities. Standard CAA phrase contractions, such as RARAU (RAdio Range Appears Unreliable), are used.

Every 3 hours special data concerning pressure changes, types of clouds, past weather, and snow depth is transmitted in figure groups, by selected stations. This information is used by the forecaster for special purpose maps and charts.

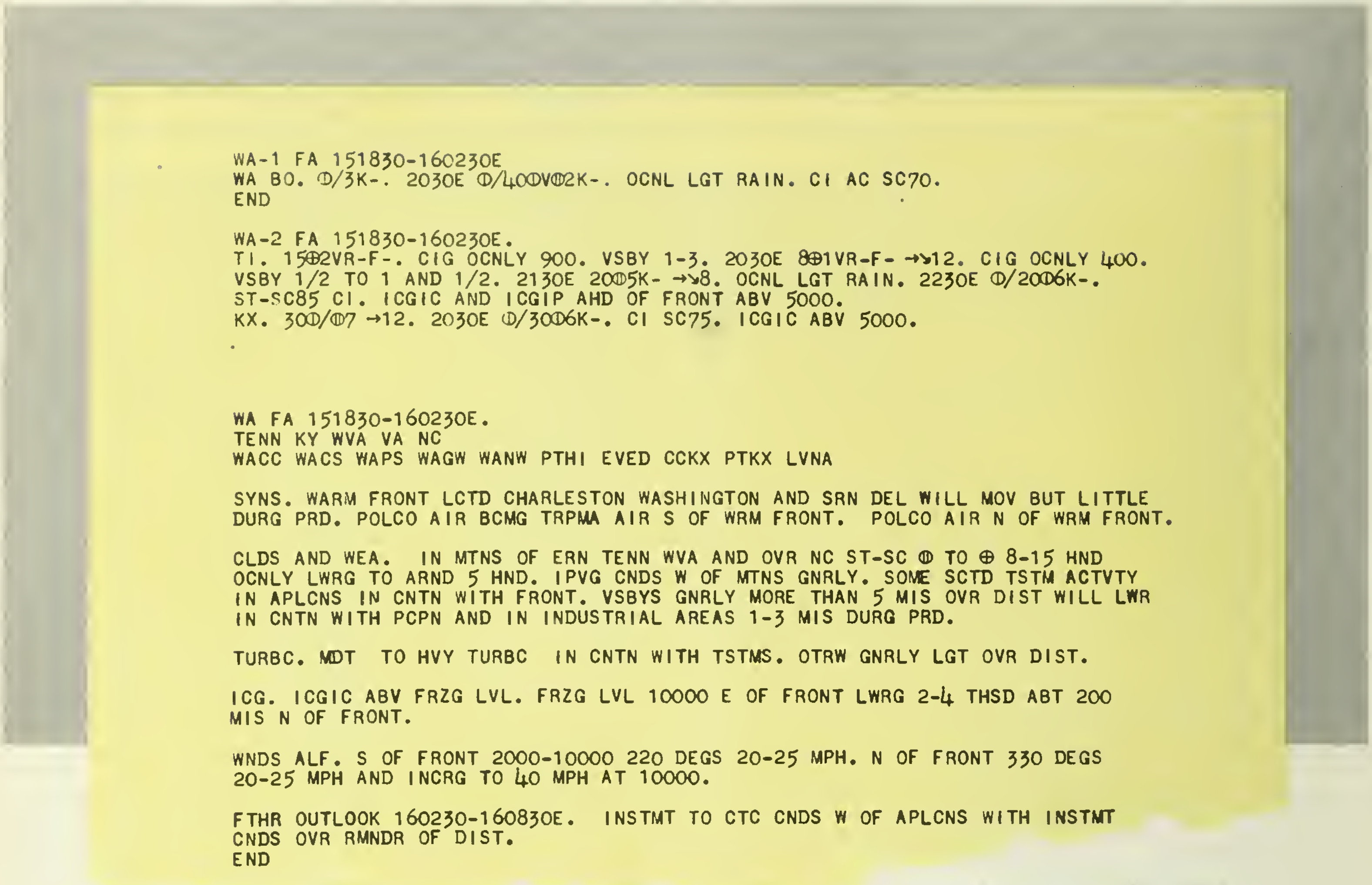
Teletype Forecasts

Teletype regional and terminal forecasts are prepared by Weather Bureau regional forecasting centers every 6 hours. Each forecast covers an 8-hour period to follow. They differ chiefly in the area covered. Each forecast has a standardized form that should be familiar to you wherever you are in the United States.

Although subject to the same limitations as any other forecast, teletype forecasts are invaluable aids in careful flight planning.

Regional forecasts are of particular value in that they give you a forecast of the probable weather conditions over a large area. The forecast period is shorter than in Army forecasts and permits a more detailed discussion. Also, regionals follow the routes covered by airways.

Terminal forecasts are prepared to cover conditions at the major terminals along the airways. They are more specific in time and area than the regionals. Special attention is given to landing weather. Check the forecasts for fields along your intended route, at your destination and possible alternate.



```
WA-1 FA 151830-160230E
WA BO. ⦶/3K-. 2030E ⦶/40⦶V⦷2K-. OCNL LGT RAIN. CI AC SC70.
END

WA-2 FA 151830-160230E.
TI. 15⊕2VR-F-. CIG OCNLY 900. VSBY 1-3. 2030E 8⊕1VR-F- →↘12. CIG OCNLY 400.
VSBY 1/2 TO 1 AND 1/2. 2130E 20⦶5K- →↘8. OCNL LGT RAIN. 2230E ⦶/20⦶6K-.
ST-SC85 CI. ICGIC AND ICGIP AHD OF FRONT ABV 5000.
KX. 30⦶/⦷7 →12. 2030E ⦶/30⦶6K-. CI SC75. ICGIC ABV 5000.


WA FA 151830-160230E.
TENN KY WVA VA NC
WACC WACS WAPS WAGW WANW PTHI EVED CCKX PTKX LVNA

SYNS. WARM FRONT LCTD CHARLESTON WASHINGTON AND SRN DEL WILL MOV BUT LITTLE
DURG PRD. POLCO AIR BCMG TRPMA AIR S OF WRM FRONT.  POLCO AIR N OF WRM FRONT.

CLDS AND WEA.  IN MTNS OF ERN TENN WVA AND OVR NC ST-SC ⦷ TO ⊕ 8-15 HND
OCNLY LWRG TO ARND 5 HND. IPVG CNDS W OF MTNS GNRLY. SOME SCTD TSTM ACTVTY
IN APLCNS IN CNTN WITH FRONT. VSBYS GNRLY MORE THAN 5 MIS OVR DIST WILL LWR
IN CNTN WITH PCPN AND IN INDUSTRIAL AREAS 1-3 MIS DURG PRD.

TURBC. MDT  TO HVY TURBC  IN CNTN WITH TSTMS. OTRW GNRLY LGT OVR DIST.

ICG. ICGIC ABV FRZG LVL. FRZG LVL 10000 E OF FRONT LWRG 2-4 THSD ABT 200
MIS N OF FRONT.

WNDS ALF. S OF FRONT 2000-10000 220 DEGS 20-25 MPH. N OF FRONT 330 DEGS
20-25 MPH AND INCRG TO 40 MPH AT 10000.

FTHR OUTLOOK 160230-160830E.  INSTMT TO CTC CNDS W OF APLCNS WITH INSTMT
CNDS OVR RMNDR OF DIST.
END
```

TERMINAL AND REGIONAL FORECASTS

Terminal forecasts follow this form:

Station(s). Ceiling, sky, visibility, weather, wind. Time of weather change, ceiling, sky, etc. Clouds, height of base, types, height of top. Remarks. Illustrated is the Washington (forecast center) Airways Forecast, 6:30 p.m. on the 15th to 2:30 a.m. on the 16th of the month.

Terminal forecast for Washington National (WA) and Bolling Field (BO): High scattered clouds, 3 miles visibility in light smoke until 8:30 p.m., then high scattered with a lower deck at 4000 feet, scattered variable to broken, visibility 2 miles in light smoke. Occasional light rain. Clouds: cirrus and altocumulus with stratocumulus topped at 7000 feet.

Regional forecasts follow the form of the example:

States: Tennessee, Kentucky, West Virginia, Virginia, and North Carolina. Includes the routes: Washington to Cincinnati, Washington to Charleston . . . Pittsburgh to Huntington . . . Louisville to Nashville.

Synopsis (the overall weather picture): Warm front located at Charleston, Washington, and southern Delaware will move but little during period. Polar continental air becoming tropical maritime air south of warm front. Polar continental air north of warm front.

Clouds and weather: In mountains of eastern Tennessee, West Virginia, and over North Carolina, stratus to stratocumulus broken to overcast 800-1500 feet occasionally lowering to around 500. Improving conditions generally. Some scattered thunderstorm activity in Appalachians in connection with front. Visibilities, generally more than 5 miles over district, will lower in connection with precipitation and in industrial areas one to three miles during this period.

Turbulence: Moderate to heavy turbulence in connection with thunderstorms. Otherwise generally light over district.

Icing: Icing in clouds above freezing level. Freezing level above 10,000 feet east of front, lowering 2000 to 4000 about 200 miles north of front.

Winds aloft: South of front, 2000 to 10,000 feet, 220°, 20-25 mph. North of front, 330°, 20-25 mph and increasing to 40 mph at 10,000.

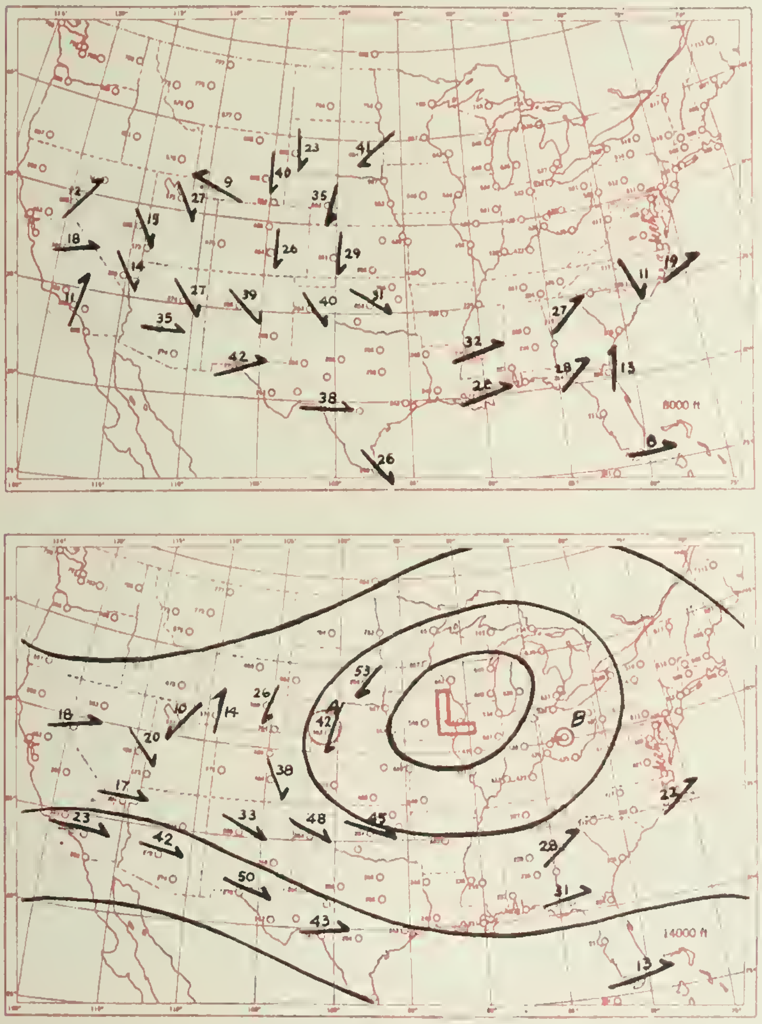
Further outlook, 2:30 to 8:30E: Instrument to contact conditions west of Appalachians with instrument conditions over remainder of district.

WEATHER ALOFT

Weather aloft is of direct concern to you in flight. It is the weather you encounter; it determines your altitude, route, and procedure. It may determine whether or not you make the flight. You get the most benefit from the data by planning this portion of your flight with the forecaster.

Winds Aloft

Winds aloft charts are prepared by the weather station from winds aloft reports. A forecast based on this information is necessary before you take off on your flight if you expect to follow any schedule at all on your flight plan. Wind direction and velocity are plotted for every 2000 feet from the ground up to 14,000 feet; an additional plotting is made for 20,000 feet.



The illustration shows the 8000 and 14,000-foot sections of a winds aloft chart.

Arrows at stations indicate wind direction at chart level. Each arrow points with the wind.

Figures above each arrow indicate wind velocity, as observed at that station.

Isobars shown on the 14,000-foot map represent the air circulation based on pressure readings at the 15,000-foot level.

When weather has prevented pilot balloon ascents, large areas of maps may not have wind reports plotted. RAWINS (radio wind soundings) are not yet plentiful enough to fill all such areas. However, you can estimate winds existing at the time of the chart by referring to the isobars shown.

Many weather stations plot **constant level charts** showing the limits of pressure, temperature, and humidity at the same constant levels as the isobars drawn on the winds aloft charts.

To Use the Isobars

Winds blow parallel to the isobars at altitudes.

Northern Hemisphere winds blow clockwise around highs, counter-clockwise around lows.

Spacing between isobars indicates wind velocity: wide spacing, low winds; close spacing, high winds.

For approximate wind speed consult another area where the spacing is the same at that latitude and level, and where winds are plotted. Values will be approximately the same. For example:

Stations A and B are located in areas where spacing of isobars and latitude are approximately the same. Wind velocity is 42 mph at 14,000 feet over station A. Wind should, therefore, approximate 42 mph at 14,000 feet over station B.

Winds Aloft Forecast

Get an estimate of the probable winds aloft for at least three different levels for the trip. If a forecaster is available, he will prepare it; if not, estimate probable wind direction and velocity yourself.

The winds aloft forecast is based upon an estimate of the movement of pressure fields, as observed on weather maps and various levels aloft.

This forecast is necessary in planning headings, groundspeed, ETA, and most efficient flight altitude. Use this data along with the adiabatic chart to get a clear picture of all pertinent information.

Winds Aloft Sequences

You may plan to take off from a civilian airport where winds aloft may not be plotted on charts as they are in AAF weather stations. CAA teletyped forecasts have a special winds aloft forecast section.

In addition, the teletype winds aloft reports from which charts are normally constructed are filed for your information.

ANALYSIS OF ADIABATIC DIAGRAM

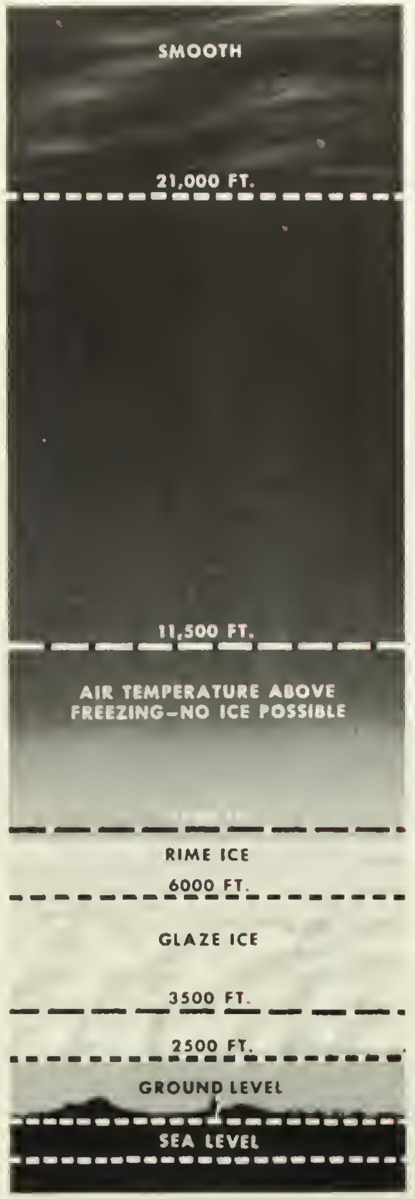
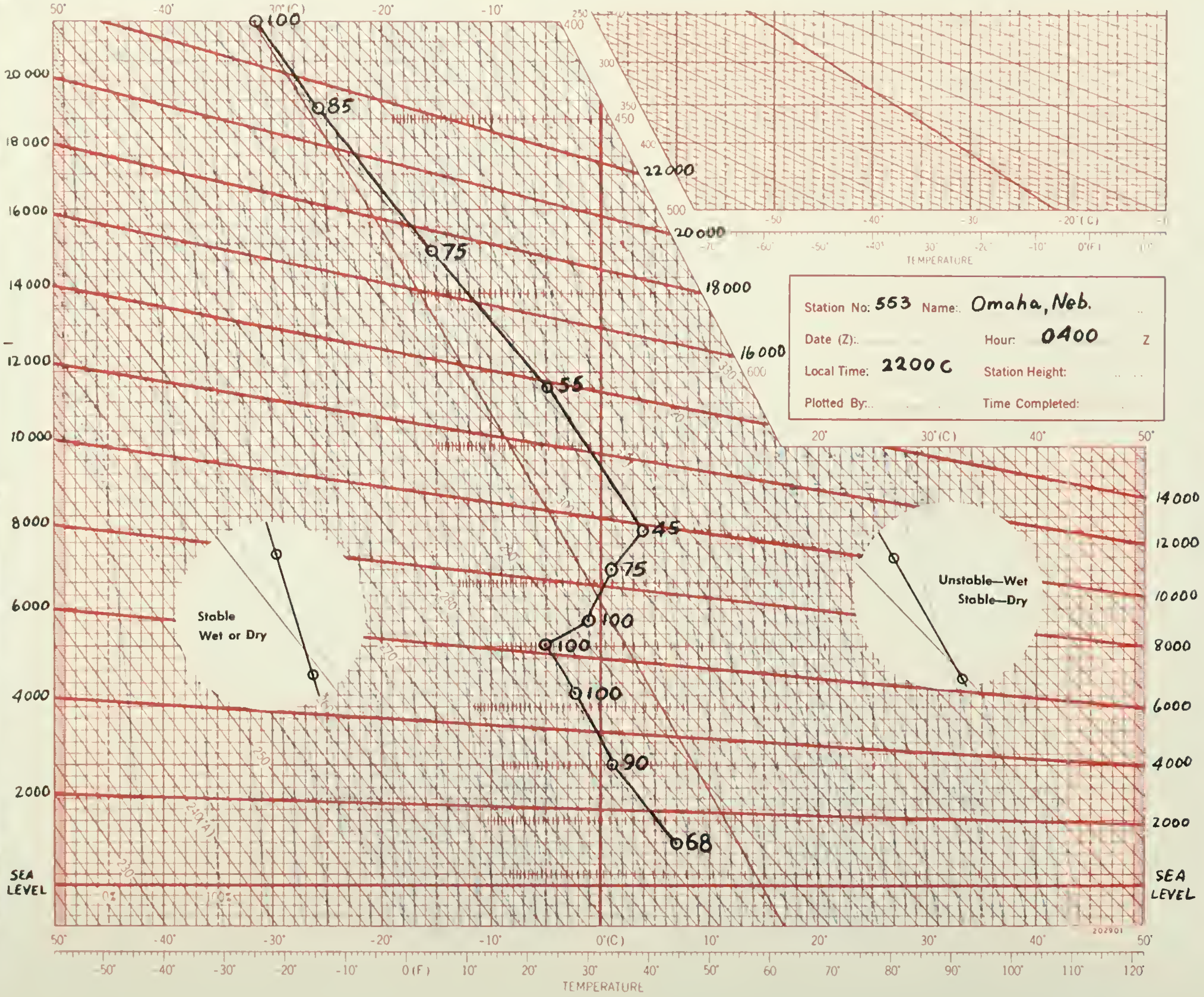


Illustration of upper-air weather at Omaha, as determined by atmospheric soundings shown on the typical pseudo-adiabatic diagram opposite.



Station No: 553 Name: Omaha, Neb.

Date (Z): Hour: 0400 Z

Local Time: 2200 C Station Height:

Plotted By: Time Completed:

ADIABATIC DIAGRAMS

Adiabatic diagrams give a remarkably accurate picture of the vertical cross-section of the atmosphere, within flight limits, for the entire country.

Atmospheric soundings are obtained by radiosonde at 0400 and 1600 Z time at more than 60 separate stations throughout the United States. The information obtained is plotted on pseudo-adiabatic diagrams posted in the weather station. The forecaster, using his weather charts, can describe practically all weather conditions you will encounter in flight, the best altitudes to fly, and routes to follow.

The adiabatic diagram indicates:

Clouds—in general, upper and lower limits; general types.

Smoothness or roughness of layers of air.

Icing zones and types of ice you may encounter.

The source of any precipitation noted in teletype weather reports.

The most important weather information you use in flight has its source in the soundings. They are dependable means for determining conditions aloft. Know how to read them yourself so you can plan flights more intelligently. Discuss the adiabats with the forecaster; he has later information on weather trends that make them even more useful.

Construction and Reference Lines

Plotted line—free air temperature or lapse rate curve. Circled dots indicate significant points.

Figure to the right of each point—relative humidity at that level.

Red diagonal lines—dry reference lines.

Blue broken lines—wet reference lines.

Red verticals—temperatures Centigrade.

Heavy vertical—0° Centigrade (overprint).

Red horizontals—pressure altitudes (overprint).

Other lines on the diagram are of interest only to the weather man. They assist him in making detailed forecasts.

Procedure

If the relative humidities in the layer under consideration, as indicated by the figures to the right of each point, are 85% or greater, clouds exist—use the wet (broken blue) reference line.

If relative humidities are below 85%, the air is clear—use the dry (diagonal red) reference line.

These dry and wet reference lines are used to determine the stability of the air in a given layer. Use the reference line nearest the plotted curve. Read up, from lower to higher levels, when you use the diagram.

If the plotted line slopes up to the right of the reference line selected, the air is stable.

If the plotted line parallels that reference line, the air probably is unstable.

If the plotted line slopes to the left of the reference line, the air definitely is unstable.

Turbulence:

Stable air is smooth air; unstable air is rough air.

The thicker the unstable layer, the rougher the air.

Clouds:

Smooth air and high humidity indicate stratus-type clouds.

Rough wet air indicates cumulus-type clouds.

Icing:

Wing icing is probable whenever the temperatures are at or below 0°C and humidity at that level is more than 85%, indicating clouds.

Cumulus clouds at any temperatures below freezing indicate probable clear icing. Clear icing is possible at temperatures down to −40°C.

Stratus clouds below 0°C and moderately unstable wet air below −15°C indicate rime icing.

Rain or drizzle falling through air below 0°C is freezing rain. Expect clear icing. The adiabat will show a warmer layer above, where you may fly with greater safety.

SECTION C FORM 23

The forecaster fills out Section C of your Form 23. Section C includes a route forecast, in addition to the existing weather. Read and discuss all entries made in Section C with the forecaster if you have the slightest doubt of their meaning. Know the meaning of every entry before you take off.

Section C, Form 23 contains the following entries:

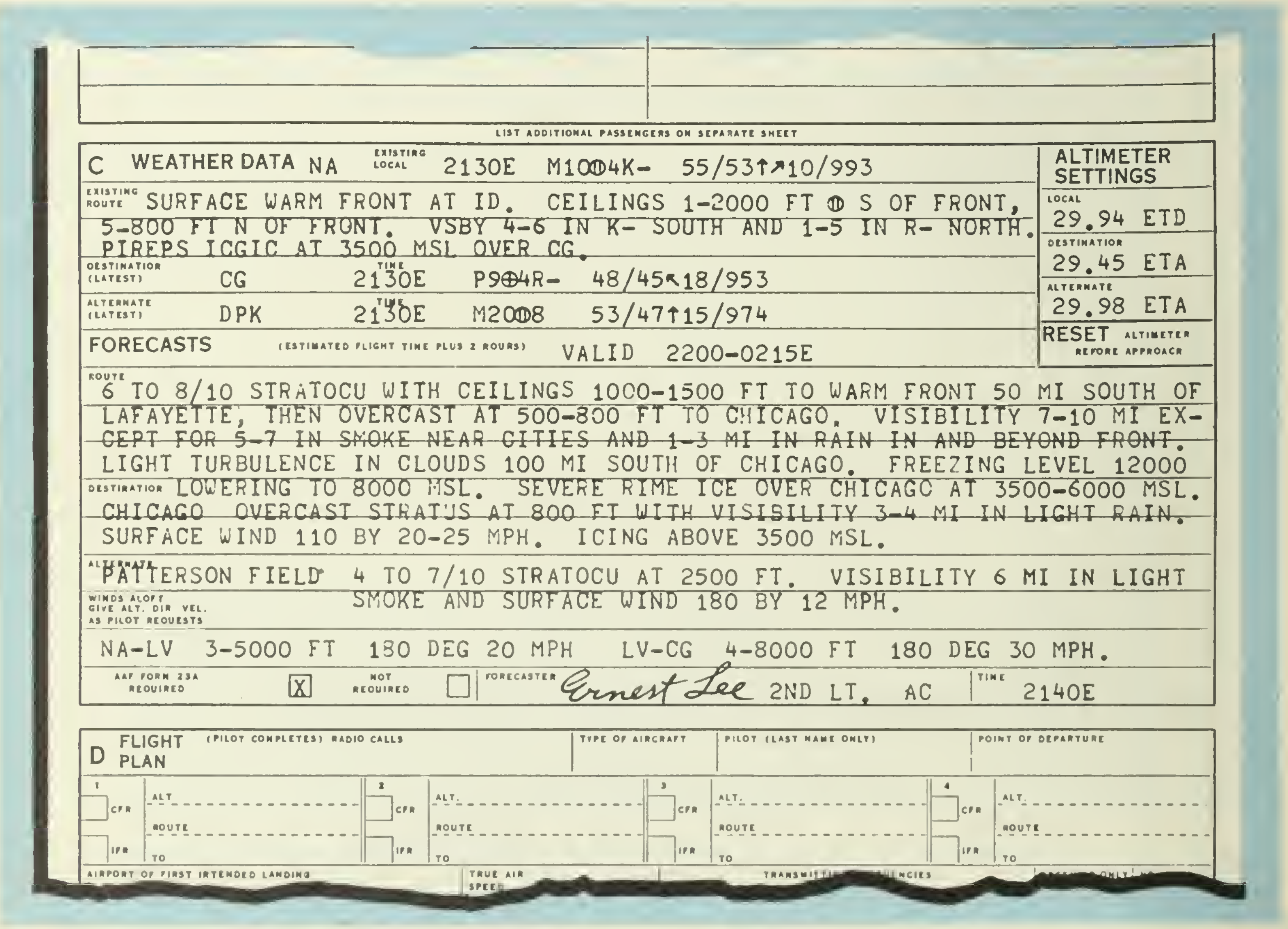
Existing weather data — extracted information from the latest reports at point of departure, stations along the route, destination, and alternate. The forecaster uses standard teletype symbols and abbreviations.

Altimeter settings—all altimeter settings are forecast for ETD and ETA.

Forecasts (trip)—no weather symbols or abbreviations are used in the forecasts. The information covers a strip extending approximately 25 miles on each side of the route.

The forecaster supplies this information as an adviser only, he has no clearance authority. However, final clearance is made on the basis of information which he supplies. If there is no forecaster on duty, you may certify that you have checked the weather situation and have found it satisfactory within the limits of your flying qualifications. If the clearance officer is reasonably sure that conditions are favorable for flight, he may give you clearance.

Command pilots and pilots with a valid green card need only check the weather and certify that they are willing to assume the clearance authority.



LIST ADDITIONAL PASSENGERS ON SEPARATE SHEET

C WEATHER DATA NA EXISTING LOCAL 2130E M10⦶4K- 55/53↑↗10/993

EXISTING ROUTE SURFACE WARM FRONT AT ID. CEILINGS 1-2000 FT ⦶ S OF FRONT, 5-800 FT N OF FRONT. VSBY 4-6 IN K- SOUTH AND 1-5 IN R- NORTH. PIREPS ICGIC AT 3500 MSL OVER CG.

DESTINATION (LATEST) CG TIME 2130E P9⊕4R- 48/45↖18/953

ALTERNATE (LATEST) DPK TIME 2130E M20⦶8 53/47↑15/974

ALTIMETER SETTINGS
LOCAL 29.94 ETD
DESTINATION 29.45 ETA
ALTERNATE 29.98 ETA
RESET ALTIMETER BEFORE APPROACH

FORECASTS (ESTIMATED FLIGHT TIME PLUS 2 HOURS) VALID 2200-0215E

ROUTE 6 TO 8/10 STRATOCU WITH CEILINGS 1000-1500 FT TO WARM FRONT 50 MI SOUTH OF LAFAYETTE, THEN OVERCAST AT 500-800 FT TO CHICAGO. VISIBILITY 7-10 MI EXCEPT FOR 5-7 IN SMOKE NEAR CITIES AND 1-3 MI IN RAIN IN AND BEYOND FRONT. LIGHT TURBULENCE IN CLOUDS 100 MI SOUTH OF CHICAGO. FREEZING LEVEL 12000 LOWERING TO 8000 MSL. SEVERE RIME ICE OVER CHICAGO AT 3500-6000 MSL.

DESTINATION CHICAGO OVERCAST STRATUS AT 800 FT WITH VISIBILITY 3-4 MI IN LIGHT RAIN. SURFACE WIND 110 BY 20-25 MPH. ICING ABOVE 3500 MSL.

ALTERNATE PATTERSON FIELD 4 TO 7/10 STRATOCU AT 2500 FT. VISIBILITY 6 MI IN LIGHT SMOKE AND SURFACE WIND 180 BY 12 MPH.

WINDS ALOFT GIVE ALT. DIR VEL. AS PILOT REQUESTS
NA-LV 3-5000 FT 180 DEG 20 MPH LV-CG 4-8000 FT 180 DEG 30 MPH.

AAF FORM 23A REQUIRED ☒ NOT REQUIRED ☐ FORECASTER Ernest Lee 2ND LT. AC TIME 2140E

D FLIGHT PLAN (PILOT COMPLETES) RADIO CALLS | TYPE OF AIRCRAFT | PILOT (LAST NAME ONLY) | POINT OF DEPARTURE

1 ☐ CFR ☐ IFR ALT. ROUTE TO
2 ☐ CFR ☐ IFR ALT. ROUTE TO
3 ☐ CFR ☐ IFR ALT. ROUTE TO
4 ☐ CFR ☐ IFR ALT. ROUTE TO

AIRPORT OF FIRST INTENDED LANDING | TRUE AIR SPEED | TRANSMITTING FREQUENCIES

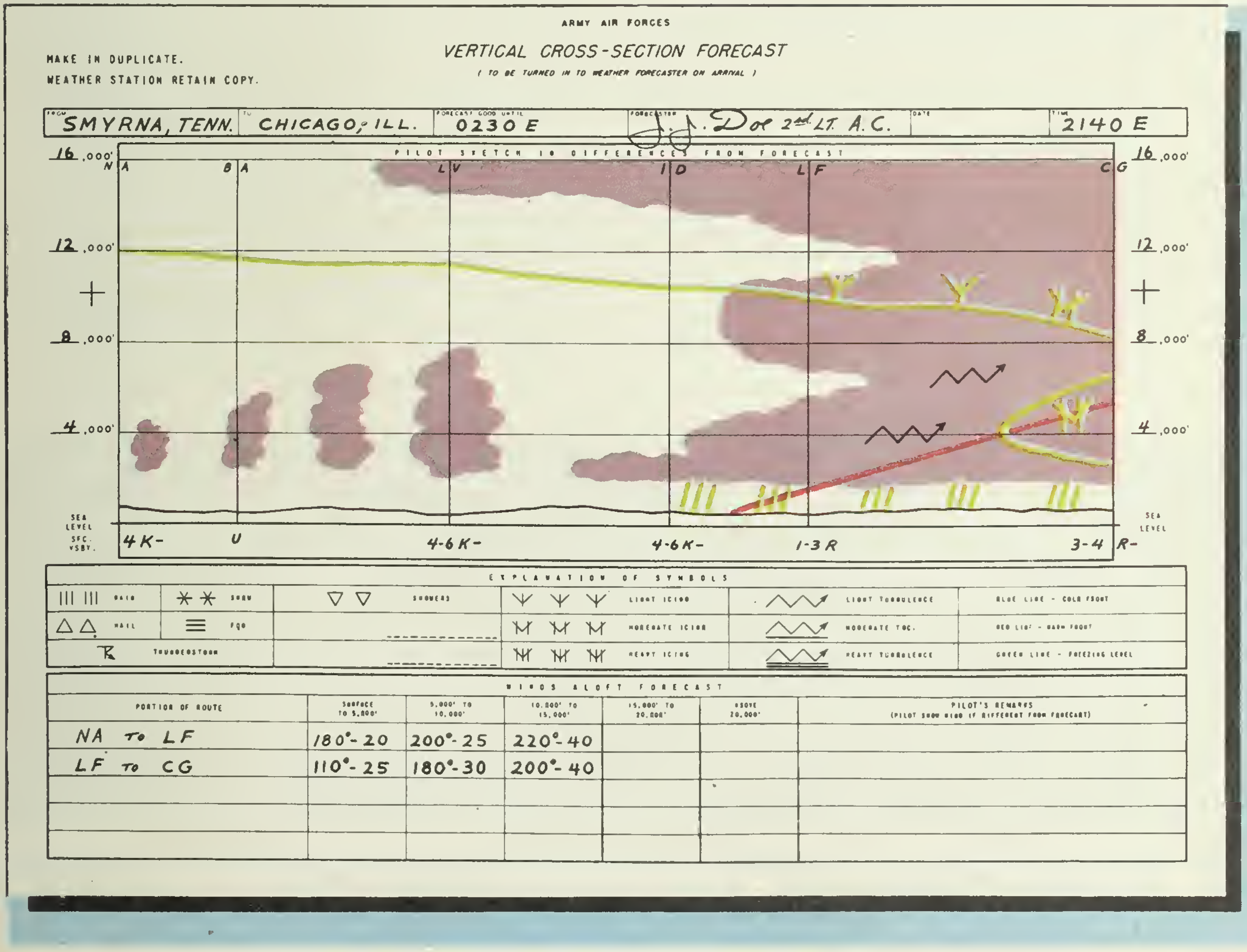
FORM 23A FORECAST

Request a Form 23A when the situation indicates that you may encounter complications in the weather along your route (for example, instrument flight through frontal areas).

The form is a graphic representation of the information contained in Section C of Form 23. It shows the weather conditions you can expect at each important point along your intended route and at your destination. A cross-section of weather conditions above and below your flight path shows areas of turbulence, icing, and precipitation, in addition to the upper and lower limits of clouds.

The Form 23A is prepared by the forecaster at your request or the directive of the clearing authority. It requires considerable time to prepare, so request one only when weather conditions require it.

When you arrive at your destination, turn in the Form 23A along with your observations of any discrepancies between the forecast and actual weather encountered. Your experience and observations may help the next man who intends to follow that route.



ARMY AIR FORCES

VERTICAL CROSS-SECTION FORECAST

(TO BE TURNED IN TO WEATHER FORECASTER ON ARRIVAL)

MAKE IN DUPLICATE.
WEATHER STATION RETAIN COPY.

FROM	TO	FORECAST GOOD UNTIL	FORECASTER	DATE	TIME
SMYRNA, TENN.	CHICAGO, ILL.	0230 E	J. J. Doe 2nd LT. A.C.		2140 E

PILOT SKETCH IN DIFFERENCES FROM FORECAST
16,000'
12,000'
8,000'
4,000'
SEA LEVEL
SFC. VSBY.
N A
B A
L V
I D
L F
C G
4K-
U
4-6K-
4-6K-
1-3R
3-4
R-

EXPLANATION OF SYMBOLS

||| ||| RAIN	✱ ✱ SNOW	▽ ▽ SHOWERS	Ψ Ψ Ψ LIGHT ICING	LIGHT TURBULENCE	BLUE LINE - COLD FRONT
△ △ HAIL	≡ FOG		MODERATE ICING	MODERATE TUR.	RED LINE - WARM FRONT
THUNDERSTORM			HEAVY ICING	HEAVY TURBULENCE	GREEN LINE - FREEZING LEVEL

WINDS ALOFT FORECAST

PORTION OF ROUTE	SURFACE TO 5,000'	5,000' TO 10,000'	10,000' TO 15,000'	15,000' TO 20,000'	ABOVE 20,000'	PILOT'S REMARKS (PILOT SHOW WIND IF DIFFERENT FROM FORECAST)
NA TO LF	180°-20	200°-25	220°-40			
LF TO CG	110°-25	180°-30	200°-40			

CLEARANCE WEATHER

Ceilings and visibility are the weather elements of greatest importance in takeoffs and landings. They determine the type of clearance to be issued.

Dust, smoke, haze, and precipitation, or a combination of these elements, are usually local restrictions which may be anticipated readily. Fog, on the other hand, may be a general condition covering an entire area of the country and is not so readily anticipated.

FOG

Think of fog as a cloud on the ground. It usually forms at night when the dissipating influence of the sun is absent. Radiation and advection fogs, the most common types, are formed when moist air is cooled by contact with an underlying surface.

Radiation Fog

Radiation fogs (ground fogs) occur most frequently in high pressure areas over land in the winter, especially in stagnant air of maritime origin. They form when the air cools at night to the dewpoint temperature. Ground fog forms in winds of 3 to 8 mph and first appears as isolated patches in valleys and depressions or, if the terrain is level, where the air has the highest moisture content. These patches may join to form a layer, which deepens until an hour or two after sunrise.

In planning a night flight, when conditions are favorable to fog, plan to reach your destination at least an hour or two before sunrise. Select an alternate which is forecast to remain open. Don't circle a field waiting for fog to lift; proceed to your alternate.

Remember that airports in moist valleys are the first to be closed by fog; airports on hillsides or high ground, last. Lacking a desirable alternate, postpone your flight so as to arrive several hours after sunrise.

At night, if it is necessary to land at a field with light ground fog, don't use your landing lights; they reflect light from the fog layer. Line up with the runway before you descend into the fog layer, for even in light fog the horizon disappears and forward visibility is reduced.

Advection Fog

Advection fog develops when warm, moist air blows over a cold surface and cools sufficiently to lower the temperature to its dewpoint. This fog may form when there is a large difference between air temperature and surface temperature, winds of 3

RADIATION FOG

to 15 mph, and high relative humidity. It is most common in **mTw** air masses.

In the winter, advection fogs are common in the southeastern states when southerly winds from the warm Gulf move in over the cold land. In the summer, southwesterly winds produce fogs off the New England coast when the warm air off the land is chilled by the cold water.

Advection fogs usually cover a wide area. If you are caught aloft, you may have difficulty in finding an alternate within your range. Consider this fact when you plan a flight into regions favorable to fog.

Sea fogs, such as the San Francisco fogs, are advection fogs resulting from airflow over adjacent warm and cold water currents. They form at sea and blow inland, to lie on coastal areas.

Sea breeze fog is an advection fog which may form when a warm land breeze blows over a cold ocean area. If a sea breeze then develops, it blows the fog back over the coastal regions. Sea breeze fogs usually dissipate after a penetration of 5 or 10 miles. Airfields close to the coast are likely to be affected by a sea breeze fog in late spring and early summer.

Precipitation fog, or frontal fog, usually is found ahead of warm fronts and often is preceded by low clouds. It forms when relatively warm rain falls through a layer of colder air at the surface. This fog often forms rapidly and covers fairly large areas. If there is a possibility of precipitation fog at your

SEA FOG
COOL MOIST AIR
WARM AND COLD WATER CURRENTS

destination, be especially careful in selecting your alternate.

Upslope fog develops when moist stable air blows uphill. It is often observed in mountainous regions, although it may also develop over a long, gradual upslope. Easterly winds often produce upslope fogs in the western Great Plains. It can exist in winds up to 35 or 40 mph.

Upslope fogs may develop rapidly and cover a large area. When you plan to fly over areas where this fog is likely to form, choose an alternate on the lee or protected side of a slope, as far downslope as possible.

Fog Warnings

1. Temperature and dewpoint only a few degrees apart, with temperature falling.
2. Clear sky with light winds to calm at night.
3. Warm moist air flowing with moderate velocity over a cold surface (cold land areas in winter and relatively cold ocean areas in spring and summer).
4. A widespread warm front precipitation area.
5. Moist stable air blowing up a broad slope.

Marginal Weather

Marginal weather exists when ceilings are reported or forecast to be below 2000 feet or the visibility less than 6 miles, except when local restrictions to visibility exist with conditions of unlimited ceilings.

Alternate Airport

An alternate airport is required for every IFR clearance. Be sure your alternate is above the minimums illustrated below. In addition, you must carry enough fuel and oil, considering all weather conditions, to be able to fly to your point of first intended landing, then to your alternate and land, with enough fuel remaining for 45 minutes of flight at normal cruising consumption.

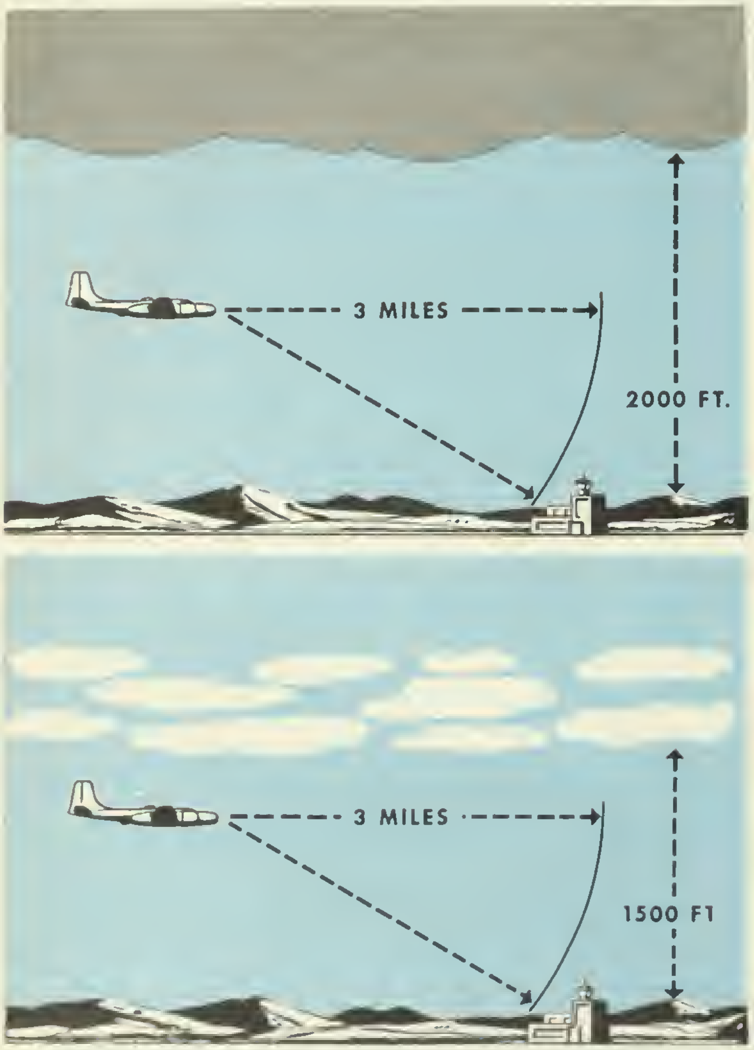
Select an alternate every time you plan a CFR flight under marginal weather conditions, although you need not enter it on your Form 23. Then, if the weather should close in at your destination, you have an alternate airport you can use.

ALTERNATE AIRPORT WEATHER MINIMUMS

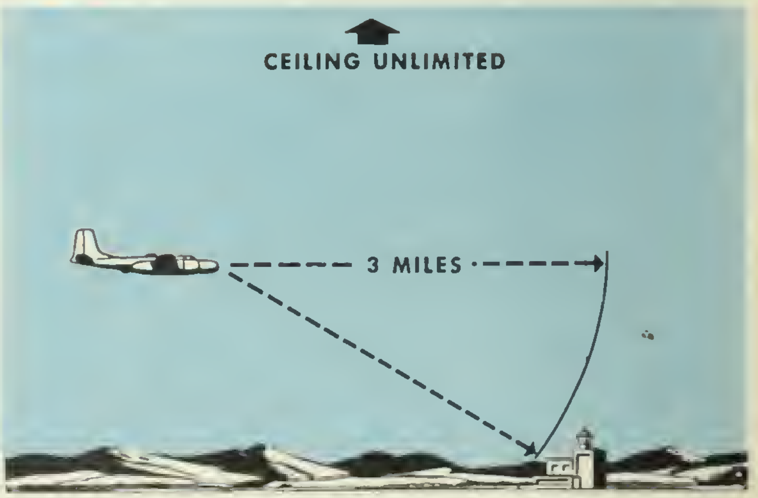
1. A landing field suitable for your airplane.
2. Weather conditions forecast to remain at or above the following minimums until after your ETA:

If equipped with a radio directional aid, ceiling 2000 feet overcast, or 1500 feet broken, and visibility 3 miles.

If not equipped with a radio directional aid, ceiling unlimited and visibility 3 miles.



WITH RADIO DIRECTIONAL AIDS



WITHOUT RADIO DIRECTIONAL AIDS

WEATHER IN FLIGHT

Icing, turbulence, and static are the important weather factors to consider for safe flying. Only if you plan your flight carefully before takeoff, and follow your flight plan, can these hazards be reduced to a minimum. Before takeoff, study the forecasts and the weather map. Discuss the weather aloft with the forecaster. Then plan your flight ahead of time, including the procedures to follow if and when you encounter severe weather conditions.

Know where these hazards are.

Plan your flight to avoid the worst conditions.

Know the proper procedures under all conditions.

Plan your emergency procedures.

Know and respect the flight characteristics and limitations of your airplane under all conditions.

Know your own limitations as a pilot.

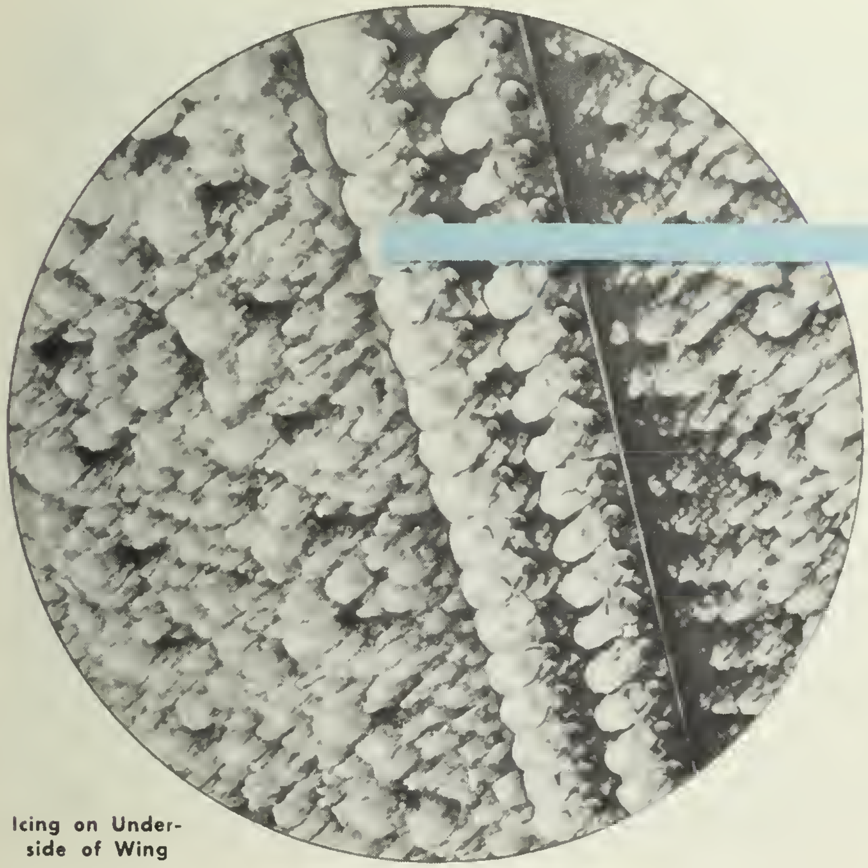
ICING ON AIRCRAFT

You can fly during icing conditions if you know where to fly, how to remove ice when you encounter it, and if you appreciate your plane's limitations under icing conditions.

Know the correct procedures for removing ice from your airplane. Avoid flying through icing zones when possible. If you must fly through zones of icing, choose a smooth flight level where less hazardous icing occurs.

If not equipped with de-icing devices, avoid all icing zones. If you encounter icing unexpectedly, get out of the icing zone as soon as possible.

It's possible to pick up surface icing in temperatures from freezing down to −40°C.



Icing on Underside of Wing

EFFECTS OF ICE

1. Reduces the efficiency of the airfoil, adds drag, and raises the stalling speed.
2. Makes the airplane difficult to control and maneuver.
3. Increases the drag of struts, fuselage, radio masts, fixed landing gear, etc.
4. Increases the load.
5. Causes certain flight instruments to give false indications or to fail completely.

TYPES OF ICE

Ice which forms on an airplane in flight is of two general types, rime and glaze (clear ice). Often, it is difficult to classify as one or the other, but usually one predominates.

Rime Ice

Rime is a granular, frosty crust, generally encountered in stable air, such as that marked by stratus cloud formations. It is formed when droplets of supercooled moisture hit the airplane.

Rime builds out from the leading edges of wing and tail surfaces, spinners, props, and fuselage. Even a light coating on the leading edges of the wings, by altering the airfoil, may raise the stalling speed.

Glaze or Clear Ice

Glaze is a glassy coating of hard ice which tends to conform to the airfoil of wing and tail surfaces. It occurs in regions of turbulence at almost any temperature below freezing, in freezing rain, and in frontal regions generally, where the temperatures range from 14°F (−10°C) up to freezing. It is formed when drops of supercooled moisture splash and spread out on the airplane, then freeze.

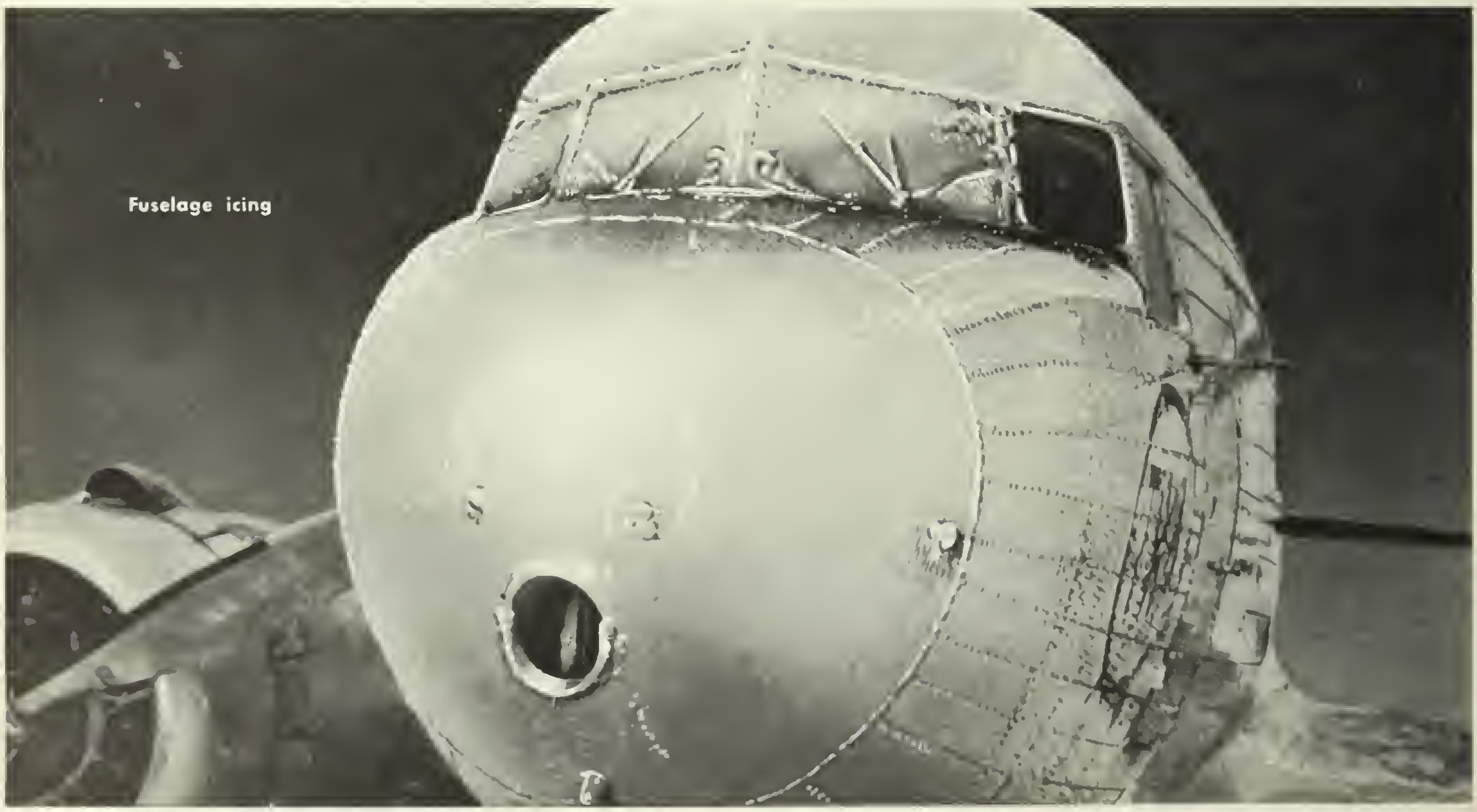
It forms a continuous shell, sometimes hard to detect, building back from the leading edges. Often it completely covers the wing and tail surfaces. Occasionally, glaze builds forward from each rivet head or protuberance, forming cones of ice that stick out into the airstream. Glaze ice, if allowed to build up, often is difficult to remove from the airplane, even when de-icing facilities are provided.

Use caution when flying at a high angle of attack; large quantities of ice can form on the lower surfaces of the wings. Such ice can be hazardous because of its weight, the fact that it forms out of reach of the de-icing boots, and because you can't see it.

OTHER FORMS

Frost is dangerous for takeoff, but not on an airplane in flight. Remove it from the wings and tail surfaces just before any takeoff. Use wing covers on the ground when conditions are favorable to frost; remove them just before takeoff.

Minute particles of moisture in the air rarely cause icing of the wings, fuselage or tail. They are too small to break through the surface friction but follow the airstream without contact with the skin. **They may cause propeller icing.** It is possible to have propeller icing without icing on other parts of the airplane.


Fuselage icing

WHERE ICING OCCURS

Prepare for icing whenever there is visible moisture in the air at temperatures approaching or below the freezing level:

1. In freezing rains, in all frontal zones.
2. In cumulus clouds and others with vertical development, wherever they occur.
3. Along fronts, in stratus and stratocumulus cloud formations.
4. In mountain (orographic) clouds, formed when moisture laden air is forced upward over hills and mountain ranges.

Sleet itself may not be hazardous, but if there is sleet on the ground, somewhere aloft there is usually a layer of freezing rain.

Look for the most severe icing in cumulus-type clouds at air temperatures below freezing. Some of the most severe icing on record occurred in the tops of thunderstorms at temperatures as low as −40°. Before takeoff, check all sources in the weather office for possible icing zones. In flight, don't rely on your free-air temperature gage for split-hair readings; skin friction, impact heating, and, in some installations, engine exhaust, may cause unpredictable errors.

Avoid icing where possible. Plan your flight to go around or over frontal formations when conditions are favorable to icing. Consult your forecaster before taking off. Analyze reports of icing carefully before following a flight plan similar to one where icing was encountered. And plan your flight accordingly.

Icing conditions never remain constant. The pilot ahead of you may have reported light icing; a few minutes later, you may find the icing severe.

PROCEDURE

If you encounter severe ice at a given altitude:

In smooth air in clouds, climb to reach a temperature below −15°C if freezing temperatures and clouds extend all the way to the ground. Descend only if you can reach ice-free conditions at an altitude with safe terrain clearance.

In rough air in clouds, descend to reach higher temperatures if you still have altitude left for safe instrument flight. Climb only to top the clouds with plenty of power and a low angle of attack.

In freezing rain, climb into the layer of warmer air above. Continue climbing as long as the temperature increases, to reach the warmest portion of the inversion. Level off when the temperature stops rising; there's another layer of icing above.

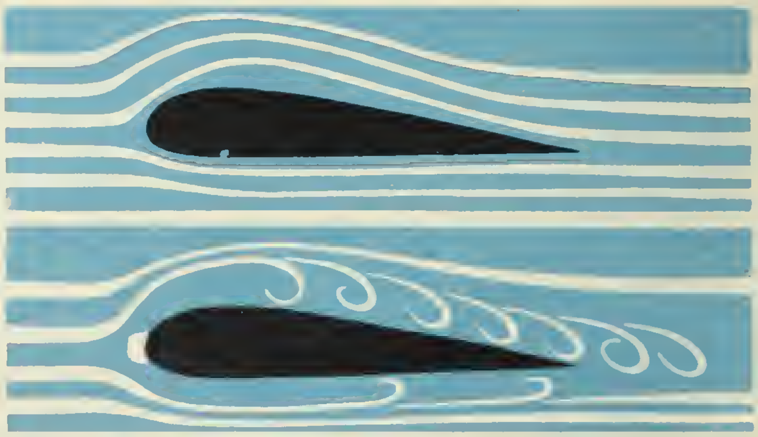
Go around or over, never under, mountain clouds. You need all the altitude you can get.

Get out of severe icing zones as soon as possible. If you enter a zone of severe icing from one comparatively free from icing, make a 180° turn before starting your climb or descent. Resume your original course when you reach the desired altitude.

Icing can be dangerous if you don't know what to do to avoid it or if you can't remove ice from critical surfaces when it occurs. **Know the limitations of your airplane in icing conditions.**

STALLS

A stall caused by ice does not feel the same as a normal stall. It occurs at a higher speed and is preceded by noticeable sloppiness of the controls. Also, the stall does not break cleanly; there is a gradual transition from normal flight, through heavy, mushy flight, to the full stall. The airplane falls off on one wing or the other, according to the individual characteristics of the plane. As your stalling speed in straight and level flight increases because of ice formation, it increases even more in banks.



PREVENTING AND REMOVING ICE

If your airplane has de-icing equipment, use it when needed. But don't fly into icing zones when you can avoid them, simply because you have this equipment. De-icing equipment is for safety when icing is unavoidable. Know how to use it.

Wings and Tail

De-icing boots are installed over the leading edges of the wing and tail surfaces of many airplanes. They are flexible rubber sheets containing inflatable fabric tubes. The tubes inflate and deflate from air pressure supplied to them by pumps. Distorting and stretching of the surface of the boots cracks and loosens the ice. The ice then is blown away by the airstream.

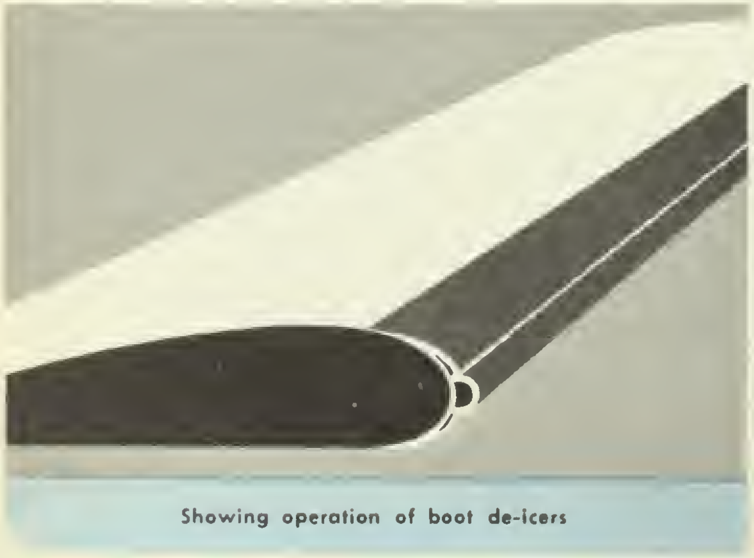
The de-icing system operates through a 40-second cycle. When you encounter icing, wait until a coating approximately ¼-inch thick builds up on the leading edge of the wing, turn your de-icers ON to break it loose, then turn them OFF. Every time a thin coating of ice builds up, repeat the process. **Test on the ground before takeoff when you anticipate icing in flight.**

Never operate boot de-icers during takeoff or landing. They act as spoilers.

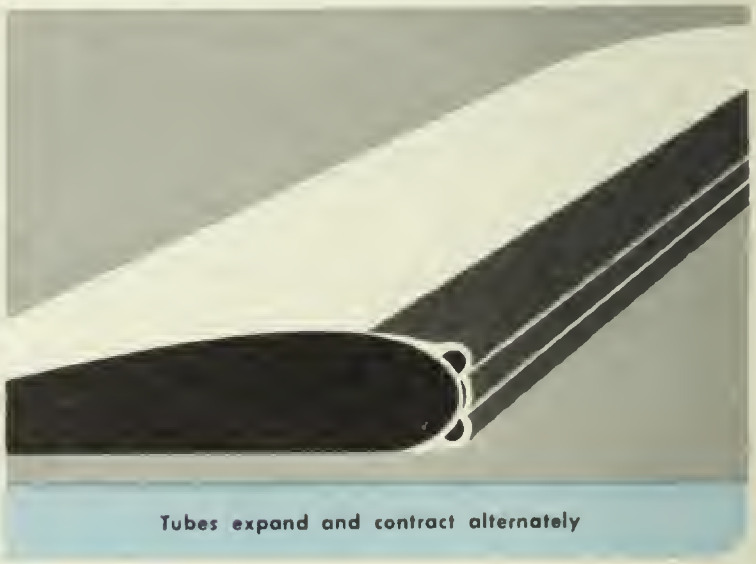
Don't use de-icers when heavy ice forms behind the boots back on the wings.

Anti-icing systems, heated wings and tails, are built into some planes for preventing ice formation. Air is heated and then passed through ducts to the leading edges of the wings and empennage, to the cabin and windshield. The surfaces are heated enough to prevent the formation of ice. When not in use, the air passes on out through a dump valve.

If you anticipate icing immediately, turn the system ON just before takeoff. Leave it on as long as you encounter icing conditions. In flight turn it ON whenever you notice or anticipate icing. Allow about 30 seconds for surfaces to heat up; ice then seems to explode off the wings and tail surfaces. If your airplane is not equipped with either system and you



Showing operation of boot de-icers



Tubes expand and contract alternately

encounter icing, change your course and altitude at once. You may be able to dislodge rime ice from leading edges by increasing speed, but leave the icing zone before trying this method of removing ice.

Airplanes with high wingloading or critical control characteristics may be seriously affected by even a small amount of wing ice. **Know the flight characteristics of your airplane in icing conditions.**

PROPELLER

Icing on propellers reduces propeller efficiency and causes vibration. It may occur in any condition favorable to icing on wings and in below-freezing zones in fog or very stable clouds consisting of extremely small moisture particles.

Ice on propeller spinner

Remove ice from propellers by one or more of the following methods:

Increase RPM of Propeller

The added centrifugal force often throws off the ice accumulation. This method is especially helpful when used in conjunction with de-icing fluid and anti-icing spinners.

De-Icing Fluid

De-icing fluid is effective in removing ice from propellers. The fluid is pumped from a tank in the airplane to a slinger ring, which distributes it to the blades. To operate:

Turn the rheostat full clockwise to drench propellers with fluid. Then turn counter-clockwise to NORMAL. If rheostat is not marked for normal setting, turn it counter-clockwise approximately half way to deliver normal output to blades.

Approximately 4 quarts of fluid per hour, for each propeller, are required for normal operation of the propeller de-icing system. Fill the tank before takeoff on any flight which may encounter icing. Turn on propeller de-icer just before you enter a zone of anticipated icing. **Test the system on the ground before a flight when conditions are favorable to icing.**

Anti-Icing Spinners

Some pitch-control mechanisms are provided with anti-icing spinners, usually coated with rubber. When covered with an oil before takeoff on flights where icing is anticipated, they help keep the propeller hubs free from ice.

PITOT TUBES

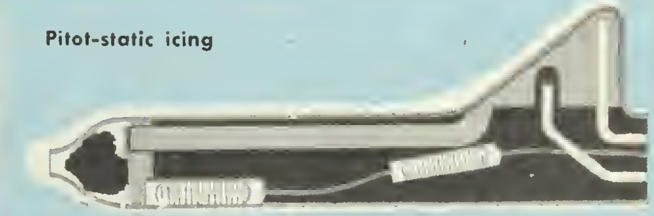
Ice on the pitot-static head affects readings of the altimeter, rate-of-climb and airspeed indicators. There is a heater in the pitot head to keep it free of ice. Whenever the free-air temperature is near or below freezing and there is visible moisture in the air, turn the pitot heater ON.

An alternate source of pressure is provided so that the altimeter and rate-of-climb indicator will continue to function should the pitot-static source fail. However the readings will differ. So when you start out on a flight, check the difference in readings at normal cruising speed, by switching from normal pitot-static source to ALTERNATE SOURCE. Then, should it be necessary to use the alternate source, you will be able to figure satisfactory readings. **The airspeed indicator will not operate at all if the pitot-static tube fails.**

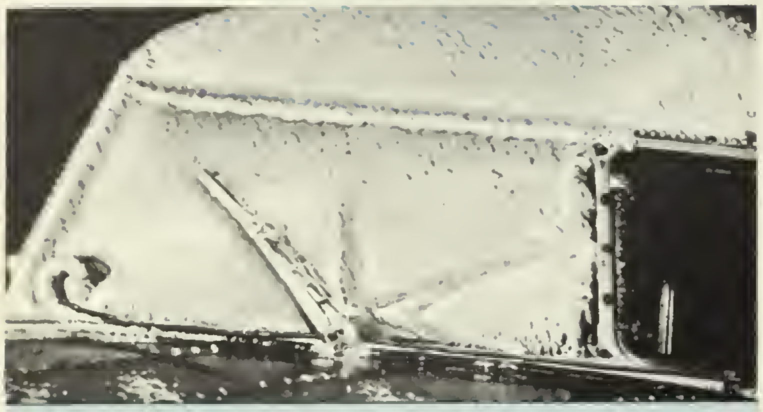
Flush-static vents are installed on many tactical airplanes. They are designed for use where the pitot source and static source are separate; there is no alternate source with this installation.

The flush-static vent is a circular plate, 2 inches in diameter, mounted on the side of the fuselage. The holes in this plate must be kept free from paint and dirt to function properly.

Pitot-static icing



WINDSHIELDS



Conserve de-icer fluid for propellers

Heated Windshields

Heated windshields, with double panes, are installed on many airplanes. Heat is supplied from the cabin heater or, when planes are equipped with heated wings, through special ducts connected to the heat exchangers. If normal vision is possible with the inner pane in place, leave it in position at all times. If inner pane is stowed normally, put it in place before taking off when icing is anticipated. Leave windshield heaters ON at all times in weather favorable to icing. The system also is satisfactory for defrosting.

De-Icing Fluid Systems

Fluid de-icers are installed on the windshields of some airplanes. When windshields so equipped begin to ice up, turn the rheostat full clockwise for maximum output, then adjust to the minimum output at which it will operate effectively. Don't waste de-icing fluid. You may need it for the propellers if icing gets more severe.

PILOT REPORTS

When you encounter icing unexpectedly, report it at once by radio. The information may help other pilots to avoid that area. Give location, upper and lower limits of the icing levels if you know them, and the amount of ice encountered.

AIR FILTER ICING

Surface icing may block air intakes when air filters are in use. In flight, when surface icing is probable, operate without filters. This is particularly true on long ferry or overwater flights.

Remove and stow filters if you have no alternate air intake. By-pass the air filter if you have an alternate air intake. Operate with filters off if they are a controllable type.

Study the procedures outlined in the Pilot Training Manual for your airplane, for operation and use of air filters under icing conditions.

Know the type of air filter installed on your airplane and the methods of preventing engine stoppage caused by air filter icing.

REFERENCES: T.O. 01-1-13 and T.O. 02-1-5

CARBURETOR ICING

Carburetor icing is possible at any time of the year, even at summer temperatures. It can occur when there is no visible moisture present in the atmosphere, and under varying combinations of conditions. Carburetor icing, therefore, should not be considered as associated exclusively with surface icing and weather.

Basically, a carburetor functions much like the expansion valve of a refrigerator. However, a carburetor may manufacture its own ice at times when you least expect it.

No two types of carburetors function alike. Icing warnings are different for each type of airplane; they may not come until it is too late to act. Procedures for preventing and removing carburetor ice vary with different models.

Know when to apply heat, just how much to apply, and what other methods to use to prevent carburetor ice in your airplane. Be familiar with specific carburetor characteristics. Follow the procedures outlined in the T.O.'s and the Pilot Training Manual for your airplane.

REFERENCE: Technical Order 02-1-5

Know the handling characteristics of your airplane under icing conditions. Don't take chances with ice!

TURBULENCE

There are two important types of turbulence:

Mechanical—caused by the horizontal movement of air (winds).

Thermal—produced by unequal surface heating or by the release of heat in air lifted above the condensation level.

Mechanical Turbulence

Mechanical turbulence may be caused by:

High winds blowing over the surface of the earth.

Moderate winds blowing over rough terrain.

Two layers of air blowing in different directions or with different velocities.

Allow plenty of terrain clearance. You can avoid most mechanical turbulence by flying at a higher altitude. This is particularly true in mountains, where eddy currents on the leeward side may cause you to drop faster than your airplane can climb.

Landing. When high winds are reported, particularly gusty winds, maintain an extra margin of airspeed until your wheels touch.

Thermal Turbulence

Thermal turbulence may be found:

Over cities, plowed fields, beaches, and highways. This is more common under contact conditions. It seldom causes anything more than physical discomfort.

In clouds, as a result of heat of condensation. An outstanding example of thermal turbulence is that found in thunderstorms. It may cause you both physical and mental discomfort if you don't anticipate it and plan for it.

Whenever you encounter thermal turbulence, avoid high speeds. You invite trouble if you dive down into the traffic pattern through the hot choppy air of a summer afternoon. You encounter the same kind of turbulence in cumulus clouds. It's very easy to exceed the load factor of your airplane in turbulence.

Keep well below the red-line speed.

Thunderstorms

All thunderstorms have the same general structure, and differ only in intensity and size. The breaker page of this section illustrates the important features of a typical thunderstorm.

Thunderstorms have three zones:

Water zone: below the freezing level.

Ice-and-water zone: freezing level to about −15°C.

Ice crystal zone: −15°C to top of cloud.

Both turbulence and icing reach their greatest intensity in the ice-and-water zone.

The chief danger of violent thunderstorms is that the pilot may become so confused that he will lose control of his plane. This may lead to structural failure as a result of improper flight.

Avoid thunderstorms, if possible.

1. Fly around them.
2. Go over them if they are not built up too high.
3. Fly under them if you can maintain contact flight with adequate terrain clearance at all times.

If you have to fly through a thunderstorm:

Reduce airspeed to a safe minimum.

In flat country fly above the roll cloud but not at too high an altitude.

Stay below the freezing level.

Maintain control but don't fight turbulence.

Keep a reasonable flight altitude.

Don't wander. Hold your heading.

Above all, keep a safe, slow airspeed, keep a reasonably constant heading, and keep your head.

Thunderstorms are mean, but they need not throw you. Just handle them right.

Lightning

Lightning is not dangerous to you in flight in all-metal aircraft. It may cause minor damage to your airplane. It may burn off your antenna, knock out your radio, or cause minor structural damage, if it happens to hit just right. Usually its greatest danger is psychological.

Keep your eyes on the instruments. All cockpit lights ON. Adjust the seat as low as possible.

Don't look outside the plane in lightning areas; you may be blinded temporarily by a flash.

Have copilot shade his eyes; then if you are blinded by a flash, he can see to fly the plane until you recover.

Report any lightning damage on the forms provided at your Operations Office, as required by AAF Regulation 60-9.

STATIC

Satisfactory radio reception is necessary for all instrument flights. It is desirable for any flight. Static (unwanted signals which interfere with the desired signal) makes radio reception difficult or impossible.

Be sure your radio equipment is functioning properly. Know the procedures necessary to minimize static.

Man-Made Static

Man-made or synthetic static is caused by radiations from electrical machines in the same frequency range as that of the desired signal. Sources within your airplane—generators, sparkplugs, landing-gear motors, wire breaks—may interfere seriously with reception. External sources—dynamos, X-ray machines, unwanted radio signals—may interfere locally. All can add to the hazards of flight in difficult weather if you fail to take corrective measures.

Before takeoff on a flight, regardless of weather conditions, check your radio with engines running to be sure it is free from engine interference.

If you notice engine interference either on your ground check or during flight, report it on Form 1A.

Know how to use your radio range filter and radio compass receiver, as discussed in PIF 2-14.

Above all, never take off into known instrument or marginal weather if your radio picks up any static from your airplane. If you do, you may be unable to use your receiver when you need it.

Natural Static

There are two types of natural static: corona or precipitation static, and lightning or crash static.

Corona static usually is encountered in areas of precipitation consisting of rain, snow, ice crystals, or in dust. It begins with a series of popping sounds, resembling engine static, gradually building up to a steady roar. Then all reception ceases. Precipitation static is confined almost entirely to flight near charged clouds, and in precipitation areas. Its intensity decreases in direct proportion to an increase in temperature above freezing.

Avoid flight through cumulus type clouds where the temperature is between 2°C and −4°C.

If flight at an altitude with static is necessary:

Reduce speed. Static increases greatly with increased speed.

If you have a radio compass, tune in desired station and switch to LOOP position. Rotate the loop to get maximum signal from the station.

If you have a trailing wire antenna, instruct the radio operator to let out approximately 100 feet of the antenna and to ground it to the frame of the airplane. Don't use the antenna near thunderstorms or where lightning is probable. It may pick up that charge.

If you have neither radio compass nor trailing antenna, key the transmitter at intervals. This discharges the accumulated charge for a short time after keying. Radio reception then is possible until the charge builds up again.

Crash static is the most common form of static you encounter in flight. It is caused by lightning discharges, sometimes as high as 100,000,000 volts, and often may be detected several hundred miles from its source.

Ultra high frequency and frequency modulation eliminate crash static. Lacking this type of equipment, try the following methods to minimize the interference:

Select the position on the range-voice-both filter that gives you the least interference, by trial. If you have a radio compass, **rotate the loop antenna so that the needle points toward the storm.** Find the most satisfactory signal ratio by trial and error.

Warning: When you use the automatic feature of the radio compass in an area where heavy lightning static is present, the automatic compass will home on a thunderstorm as surely as it does on a radio station. Watch out for it.

SEASONAL WEATHER

There are a few seasonal weather conditions to observe when flying within the continental limits of the United States. There are, of course, great differences in climate in various sections of the country. Some seasonal conditions may affect the operating characteristics of your airplane, so study the specific procedures for winter and summer flying in the T.O. and the Pilot Training Manual for your particular airplane. The procedures differ with each make and model.

Summer Weather

Weather systems are relatively weak and slow moving. Fronts are of lesser intensity than in winter. Air mass symbols on the weather map usually indicate the type of flying weather to expect.

In spring and early summer, fog may delay takeoffs and landings. As summer advances, fog is not so prevalent, but thunderstorms become the chief problem.

Winds, as a result of the thunderstorm situation, tend to be shifty and gusty. Watch your landings when this condition exists.

Winter Weather

Weather systems are strong and fast moving.

Fronts are strong and active.

Bad weather conditions are more widespread.

Winds tend to blow more steadily. Variable light winds are not so common as in the summer months.

The moist (**mP** and **mT**) air masses create widespread fogs and low ceilings, caused by the stabilizing effect of cold ground surfaces.

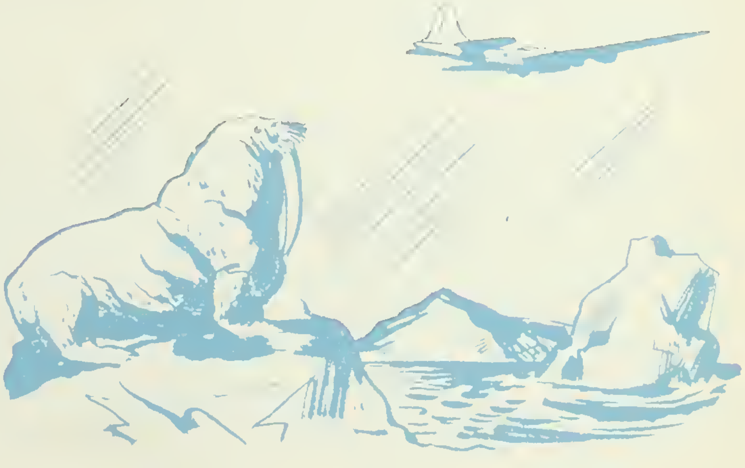
Moist cold (**mP**) air creates an icing hazard over mountains.

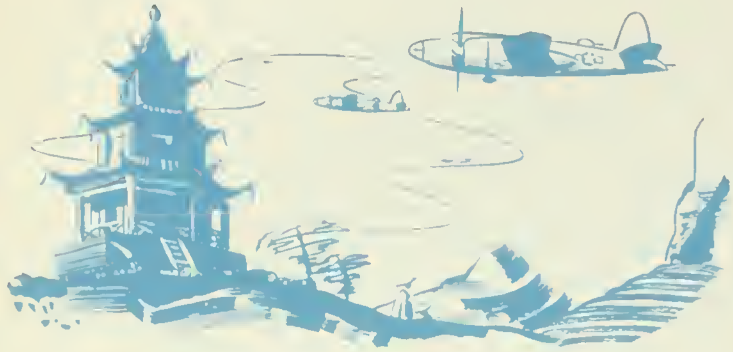
Wing icing in clouds is common at lower levels.

COMBAT WEATHER

The AAF is fighting in combat theaters throughout the world. Each theater has specific weather problems.

In Alaska and the Aleutians there are prolonged periods of icing, low ceilings, and poor visibility. The ETO has weather similar to the Pacific Northwest. North Africa and the Mediterranean provide perfect flying weather in the summer, but limited





visibilities and ceilings during the late fall and winter. Low visibility makes flying hazardous in the Balkans because of rough terrain.

The Pacific theater has violent tropical winds and well-developed thunderstorms, with heavy seasonal rains and great variations between the wet and dry seasons. In CBI most flights are on instruments over the mountains.

Weather offices in combat theaters get most of their information from combat crew reports and weather reconnaissance.

Keep accurate accounts of all weather conditions you encounter on your missions. Give a member of your aircrew the job of making weather notes during flight. Make a full report immediately upon arrival back at your base after a mission.

SEASONAL FLYING TIPS

Takeoff and Landing Runs

The takeoff run in summer is greater than in winter for the same airplane. The air is less dense in summer than in winter, so allow more runway for takeoff and more clearance beyond the runway, just as you would at a field with high elevation.

Landing runs are greater in summer for the same reason and your airplane lands hotter. After the touch-down, you need more runway.

Allow a greater distance to clear obstructions in summer; your rate-of-climb is slower.

Caution

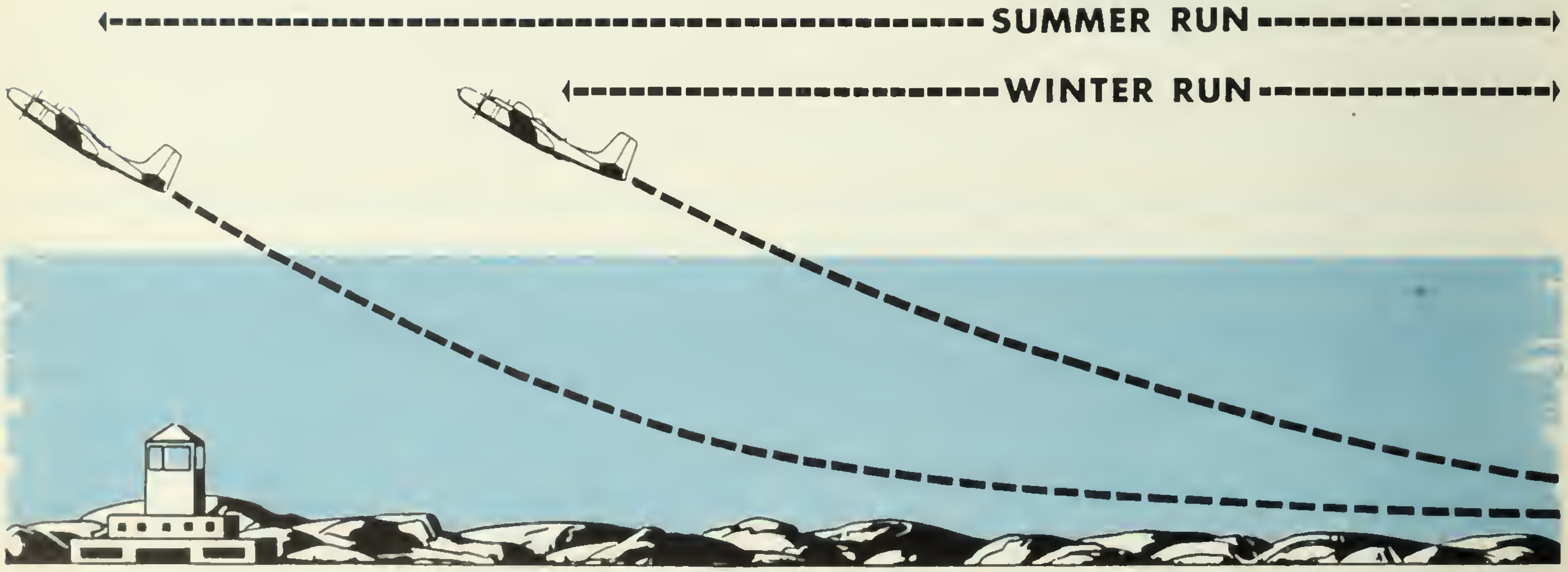
Although the airspeed indicator reads the same, the groundspeed is greater in summer than in winter because of the thinner air.

Cold Weather Operation

Read specific procedures for oil dilution in cold weather operations in the T.O. and Pilot Training Manual for your airplane. Follow instructions carefully. Oil dilution aids starting and reduces starting wear on the engine.

Use an auxiliary power source for starting or power required when engines are not running. If auxiliary power is not available, try to have batteries put in a warm place until just before the start.

Leave a hatch or panel open when parked outside to prevent windows and windshield from frosting.



RULES FOR FLYING WEATHER

Plan your flight carefully before you take off.

Check for engine static if you anticipate instrument flight.

Check de-icing equipment when conditions indicate the probability of icing.

Use caution when planning a flight into areas where fog is possible. When ground fog is forecast plan night flights to arrive an hour or two before or several hours after sunrise.

Remove any frost from the wings before takeoff.

During a winter fog or rain, watch for icing on wings from propeller blast during run-up.

Avoid slushy and icy spots when taxiing. Be easy with your brakes; you may skid.

Don't take off in wet snow in borderline temperatures if you can avoid it. It may freeze on the wings before you can gain altitude.

Know the handling characteristics of your airplane under all conditions.

Learn enough about cruise control in the airplane you are flying to conserve gasoline when necessary.

Turn the pitot heater ON whenever flying in precipitation or clouds.

Following takeoff from a wet or slushy field, operate landing gear and flaps through a few cycles when possible, to prevent freezing in position.

Avoid turbulent areas. Fly above or below clouds where possible when air temperatures are at or below freezing.

Fly where the air temperature is well above freezing. Or look for temperatures below 0°F (−18°C); you'll find less ice there.

Watch for the first signs of hazardous weather, make up your mind, then take planned corrective action.

Avoid thunderstorms when possible.

Don't fly under a thunderstorm unless you can maintain contact flight with plenty of terrain clearance.

Fly through fronts at right angles, to shorten the time in the front, and at an altitude determined before takeoff.

Once you start through a turbulent front or a thunderstorm, don't wander looking for soft spots. Hold your original heading.

Climb or descend through icing zones as fast as possible. Keep the angle of attack low.

Don't let lightning scare you; its danger is psychological. Turn up cockpit lights, adjust seat low, concentrate on your instruments, and don't stare outside the plane.

Maintain a constant listening watch. Take advantage of the weather information which Army Flight Service relays to you.

Never land during a thunderstorm. If it's moving, wait until it passes the field. Otherwise, go to your alternate.

Don't circle a field waiting for the fog to lift. Go to your alternate.

If you don't break contact at your minimum altitude on the low approach, don't mill around waiting for the ceiling to rise. Go to your alternate.

When you have ice, fly in with plenty of power for a wheel landing. Remember that stalling speed increases with ice.

With ice, make wide turns. Increase airspeed in all turns over normal. Avoid steep turns with icy wings.

Turn wing de-icers off on base leg. They act as spoilers if left on.

With ice, use flaps with care. They may aggravate a near-stalling condition.

REFERENCES: T.O. 30-100D-1, AAF Manuals No. 6 and No. 40.
CAA Bulletin No. 25

FLIGHT INSTRUMENTS

PITOT-STATIC SYSTEM

The readings of the airspeed indicator, altimeter and rate-of-climb indicator depend upon two different pressures. One is called pitot (impact or dynamic) and the other is called static (atmospheric). Actually the only instrument affected by both types of pressure is the airspeed indicator. The altimeter and rate-of-climb indicator depend solely upon static pressure.

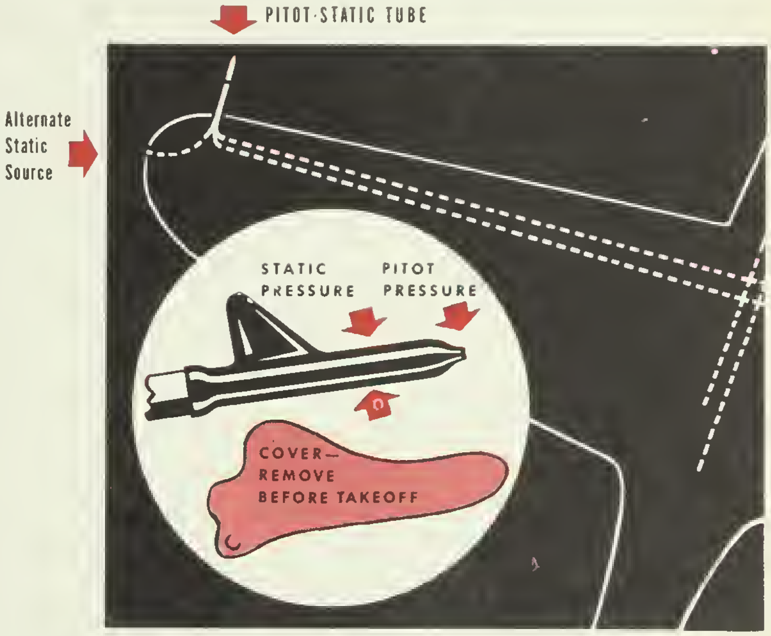
Pitot-Static Head

A pitot-static head supplies both pitot and static pressures to the airspeed indicator and static pressure alone to the altimeter and rate-of-climb indicator.

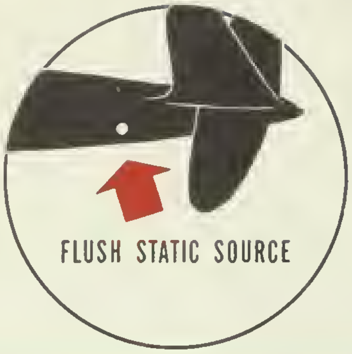
The pitot pressure opening is on the forward end of the head, while the static pressure openings are located a short distance behind the forward head.

The head is so designed that any moisture or dirt entering it is trapped and kept from reaching the instruments themselves. A heating element is provided inside the head to prevent icing.

To deliver true pressure to the instruments the pitot-static head must be streamlined with the airflow. This can be accomplished usually only at cruising speed. Thus, inaccuracies may develop at other than cruising speed, but they are negligible except during takeoff, sharp pullouts, level-offs, and landings.



REMEMBER—Always make sure the pitot-static head cover is removed before takeoff. Don't leave the pitot heater turned on for extended periods on the ground. Except for testing purposes, turn it on only in flight when icing conditions are anticipated.



Flush Static Source

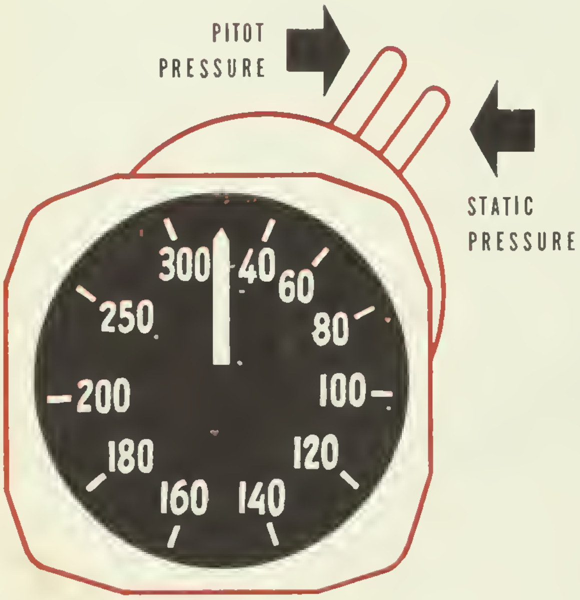
Static pressure is sometimes derived from a flush static pressure source, by means of a perforated flush-mounted plate, located usually well back on the airplane's fuselage. Pitot pressure in this system, however, is still obtained from a pitot head.

Alternate Static Source

Some airplanes have an alternate source of static pressure controlled by a switch or valve in the cockpit provided in case the usual source fails. For example, if the pitot-static head were broken off or the openings became iced, all three instruments in this group would become unreliable. By switching to the alternate you regain use of the rate-of-climb indicator and the altimeter but not the airspeed indicator, depending as it does on both pitot and static pressure.

The static pressure provided by the alternate source is usually lower than true or actual pressure. Thus, upon first switching to it, you find the rate-of-climb indicator ordinarily indicating a climb, while the altimeter ordinarily indicates an increase in altitude, though none has occurred. The rate-of-climb indicator returns to a normal indication shortly. The altimeter, however, continues to indicate an altitude other than actual.

Try the effect of the alternate source of your own airplane if so equipped, so you can be prepared for an emergency.



AIRSPEED INDICATOR

The actuating mechanism of the airspeed indicator is a metal diaphragm housed in an airtight case. Pitot pressure is admitted to the inside of the diaphragm. Static pressure is admitted to the case around the outside of the diaphragm. The difference between these two pressures causes the indications of this instrument and gives indicated airspeed (IAS). Any change in either pitot or static pressure causes a change in the IAS.

You can estimate true airspeed (TAS) roughly by adding 2% of the IAS for each 1000 feet of altitude. For example, if the reading is 140 IAS at 20,000 feet of altitude, add 40% of 140 to 140, which gives an approximately correct reading of 196 TAS. For more accurate calculations use a computer.

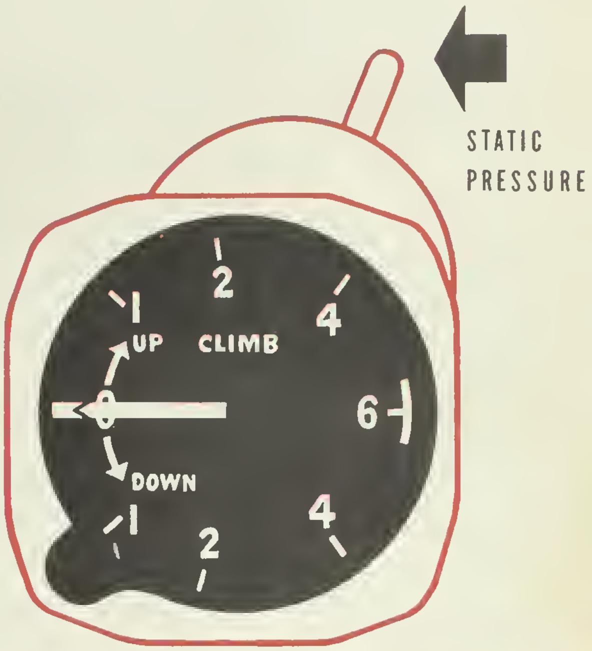
REMEMBER—With the exception of your having wing ice or an increased load, the IAS at which your plane will stall is the same, no matter what the altitude or temperature. The airspeed indicator tells you accurately your safe airspeed limits, maximum or minimum. Make corrections for stalling speed if you have picked up wing ice or increased your normal load. See PIF 3-4-1 and High Speed Stalls, PIF 2-20-1.

RATE-OF-CLIMB INDICATOR

The rate-of-climb indicator has the same actuating mechanism as the airspeed indicator. A diffuser valve simply restricts the flow of the air from the case to the inside of the diaphragm. Only static pressure is admitted to the inside of the case and the outside of the diaphragm.

You get a reading when there is a difference in pressure between the inside and the outside of the diaphragm. The difference occurs chiefly in climbing or descending, when pressure inside and outside the diaphragm tend to equalize, but this takes some time because of the restriction in the flow of air between the diaphragm and case. Because of this restriction the instrument has a lag in its indications of several seconds.

Depend on the instrument only when establishing a constant rate of climb or descent in relatively smooth air. Use it in conjunction with the altimeter at all times as it indicates the **rate of change** and not the **amount of change** in altitude. The instrument is relatively useless in turbulence.

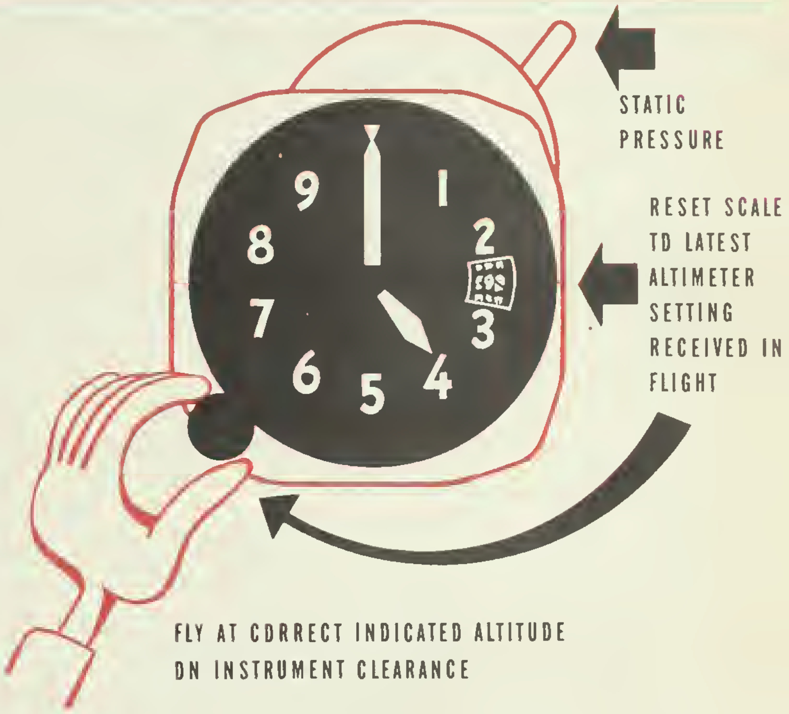


ALTIMETER

The actuating mechanism of the altimeter is called an aneroid, which is a device for measuring absolute pressure. It is housed in an airtight case. Static pressure is admitted to the inside of the case, and acts on the aneroid so as either to compress it or allow it to expand. This compression or expansion causes movement of the hands on the face of the instrument.

The altimeter actually measures the weight of the air column (barometric pressure) above it and is so calibrated that a decrease in pressure causes an increase in its indication of altitude. The weight of the air column measured by the altimeter will vary because of changes in the air's density, which in turn is affected by variations in temperature. These factors often cause incorrect altimeter readings.

The altimeter is calibrated according to standard conditions of temperature and pressure, but these conditions seldom prevail. In order to correct for non-standard conditions modern altimeters are provided with a barometric scale.



Standard Altimeter Setting

Remember this system will always give you your height above sea-level, not above the terrain. Use these steps:

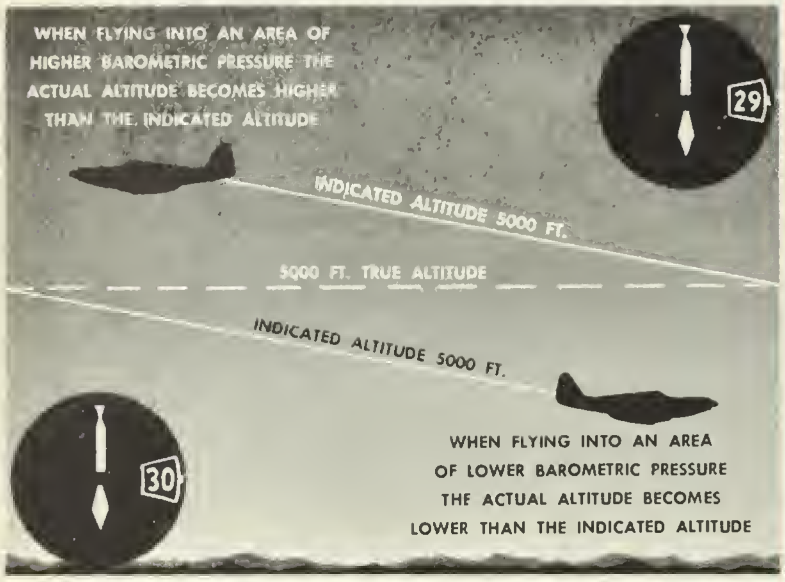
1. Before takeoff obtain the **latest altimeter setting** for the field from the tower. Then set the barometric scale on the instrument to this setting. The hands of the altimeter should then indicate the surveyed altitude of the field above sea-level. (If they do not, within the limits allowed on the scale-error card on your instrument panel, ask a mechanic to find the trouble. Often a small adjustment is enough to correct the error).

2. During flight you must continually correct the altimeter by resetting the barometric scale according to the latest altimeter setting of the area in which you are flying. Request it from the nearest radio facility.

3. Before landing again request the latest altimeter setting from the tower, and reset the instrument accordingly, so that you can depend on its accuracy.

Effects of Pressure and Temperature on Altimeter

Standard atmospheric conditions at sea-level exist when the barometric pressure is 29.92 and the temperature is 15°C. The standard temperature for any altitude above sea-level decreases at the rate of 2°C for each 1000 feet of altitude. Remember these two rules:

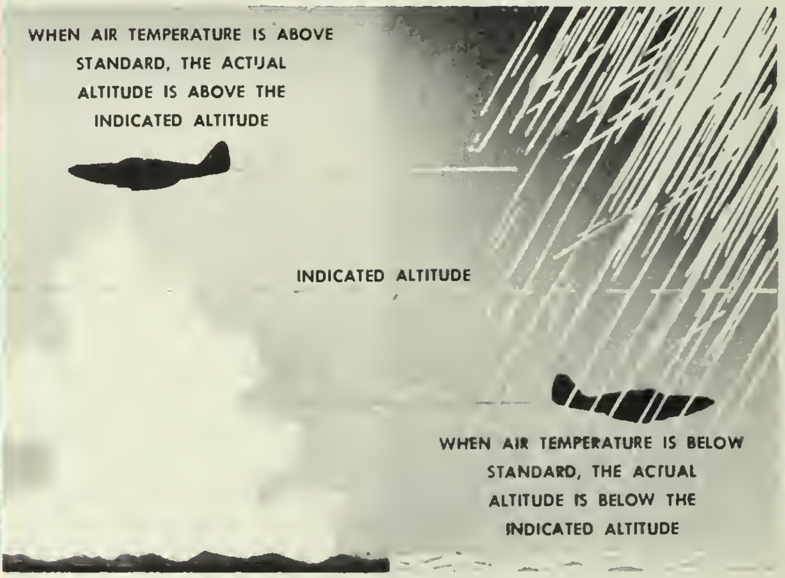

WHEN FLYING INTO AN AREA OF HIGHER BAROMETRIC PRESSURE THE ACTUAL ALTITUDE BECOMES HIGHER THAN THE INDICATED ALTITUDE
29
INDICATED ALTITUDE 5000 FT.
5000 FT. TRUE ALTITUDE
INDICATED ALTITUDE 5000 FT.
30
WHEN FLYING INTO AN AREA OF LOWER BAROMETRIC PRESSURE THE ACTUAL ALTITUDE BECOMES LOWER THAN THE INDICATED ALTITUDE

ALTITUDE AND PRESSURE

Rule 1—In flying from an area of relatively high pressure into an area of lower pressure the actual altitude will become lower than the indicated altitude. This is a dangerous situation.

ALTITUDE AND TEMPERATURE

Rule 2—When flying through air colder than standard the actual altitude becomes lower than the indicated altitude. WHAT TO DO: Calculate your true altitude by use of a computer.


WHEN AIR TEMPERATURE IS ABOVE STANDARD, THE ACTUAL ALTITUDE IS ABOVE THE INDICATED ALTITUDE
INDICATED ALTITUDE
WHEN AIR TEMPERATURE IS BELOW STANDARD, THE ACTUAL ALTITUDE IS BELOW THE INDICATED ALTITUDE

WARNING

Before clearing for an instrument flight, be sure the altitude you have requested gives you sufficient terrain clearance over your entire route. Then keep your altimeter reading at this altitude. Don't make mental corrections and try to figure your true altitude. Keep your indicated altitude corrected by resetting your altimeter from settings given you over your radio check points.

MAGNETIC COMPASS

The magnetic compass is the basic navigational instrument. It consists of an airtight case filled with a special fluid in which a compass card assembly is pivoted. It is subject to many errors; mainly deviation and the errors produced by turning, accelerating or decelerating the airplane.

A compass correction card mounted on the instrument panel shows the amount of deviation.

Note the following errors in turning:

When turning toward North the indication of the compass lags considerably. In most sections of the United States this lag amounts to approximately 30°. When turning toward South the compass indication leads the airplane's direction on the heading by the same amount. These errors decrease as you make a turn toward East or West, becoming approximately zero on those headings.

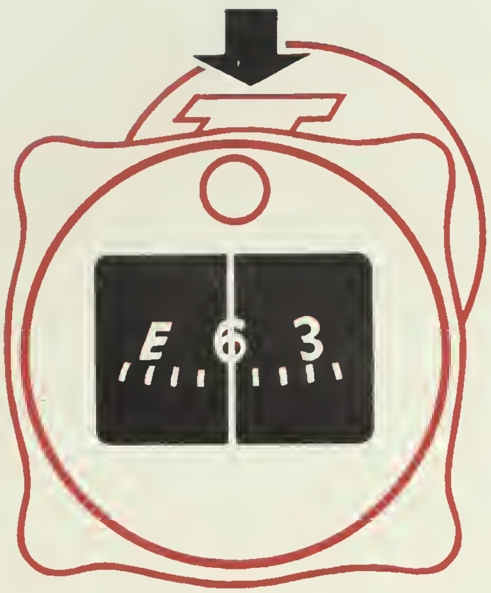
The rule becomes, then; **Overturn the heading when turning toward directions on the Southern half of the card** (points between East and West through South). **Underturn the heading when turning toward directions on the Northern half of the card** (points between East and West through North).

Example

For instance, if you are flying a heading of 280° and want to change your heading to 360°, your magnetic compass lags approximately 30° behind your turn; so straighten out when your compass reads 330°. Your compass will catch up shortly.

If you are flying a heading of 100° and make a turn to a new heading of 180°, continue your turn until your magnetic compass reads 210°, that is, 30° more than the heading you want. In a few moments the compass swings back to its proper reading.

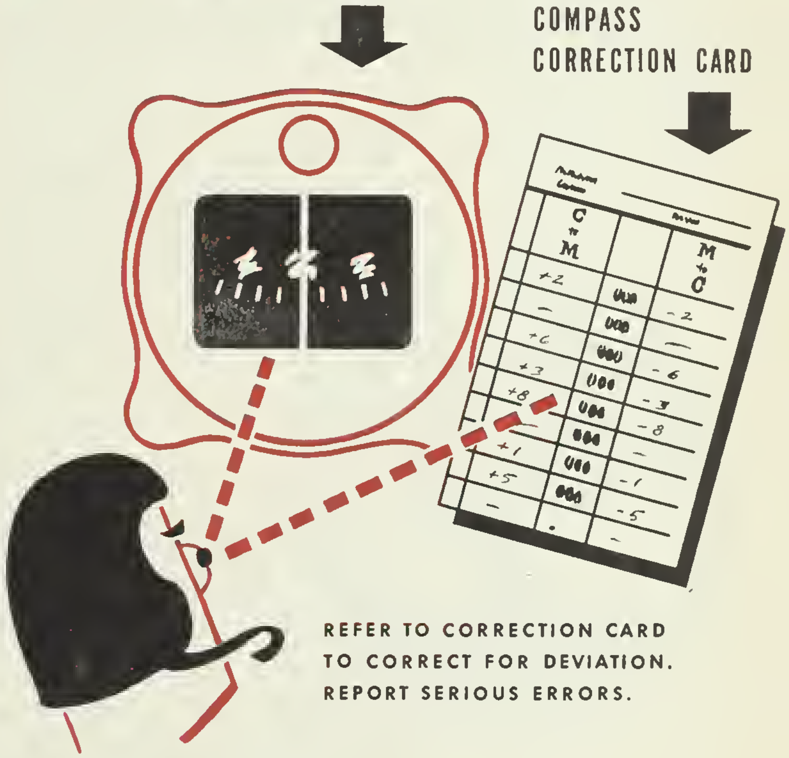
When you accelerate or decelerate the airplane in an Easterly or Westerly direction you will notice an error as the compass turns off the direction in which you are flying. When heading East or West acceleration causes the compass to indicate a turn toward the North. You get the same effect by going abruptly into a dive on these headings.



Deceleration on a heading of East or West causes the compass to indicate a turn toward the South. You get the same effect by going abruptly into a climb on these headings. These rules apply only in the Northern hemisphere. They are exactly the opposite in the Southern hemisphere.

The magnetic compass is difficult to use in turbulence.

The compass should be swung frequently in order to keep the compass correction card up to date. If you notice serious compass errors report it on your Form 1-A. Keep metal objects and electrical equipment (such as headphones) away from the compass.



REFER TO CORRECTION CARD
TO CORRECT FOR DEVIATION.
REPORT SERIOUS ERRORS.

GYRO FLUX GATE COMPASS SYSTEM

The Gyro Flux Gate compass system is a remote indicating earth-inductor compass consisting of gyro-stabilized flux gate transmitter, an amplifier, a master indicator and from 1 to 6 remote indicating repeaters. It is not subject to the error of the magnetic compass except when the gyro flux gate is caged. A true heading is always indicated by the master and the repeater indicators, because of compensation for variation and deviation.

Its upset limits are 65° climb, glide and bank.

Although the responsibility for the operation of this compass rests on the navigator, you should know how to use it, and it is your responsibility if there is no navigator in the airplane.

Follow these steps in operation:

1. Be sure the amplifier switch is always left "ON."
2. Turn on the inverter after starting engines.
3. Cage the gyro after the compass has been in operation 5 minutes.
4. Leave it caged for 45 seconds.
5. Uncage, and it is ready for use.

If you exceed the upset limits of 65°, cage and uncage the instrument just as you did before.

Leave the gyro uncaged at all times except those indicated above.

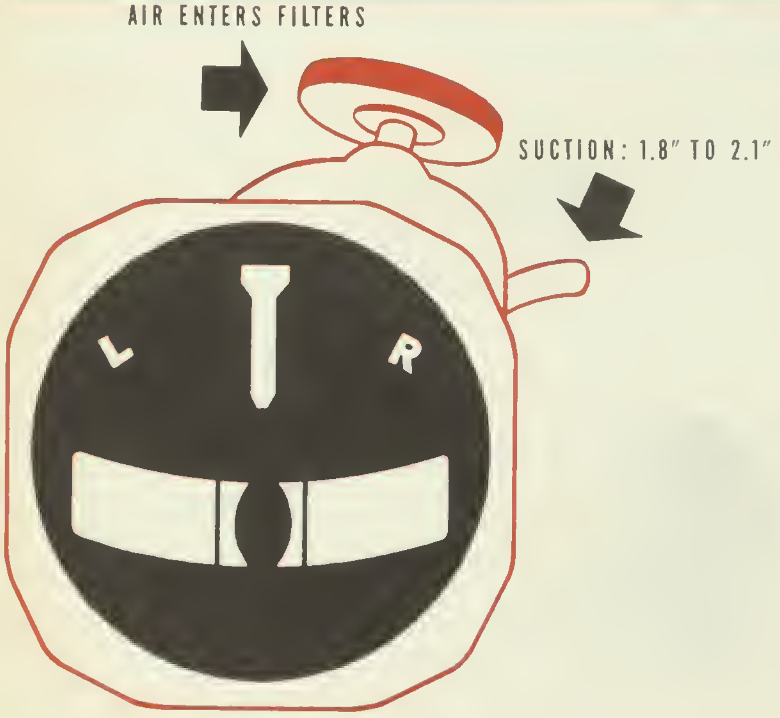
On the newer models the gyro is designed so it cannot be left in the caged position. Follow this procedure for erecting the gyro: After gyro motor has been operating 5 minutes, hold push button in until red light is on, then release push button. When red light goes out an erection cycle has been completed.

THE SUCTION SYSTEM

Gyro instruments are operated normally by suction, supplied by a vacuum pump driven by the airplane engine. Actually each gyro instrument works on the same principle as a turbo. A gage is provided to indicate amount of suction.

On modern single-engine airplanes there is no alternate source of suction. On multi-engine airplanes there are usually two or more suction pumps. A selector valve in the cockpit allows you to switch from one suction pump to another in case of engine or suction pump failure.

If your suction system fails completely you have approximately three minutes dependable use of the gyro instruments.



BANK-AND-TURN INDICATOR

The bank-and-turn indicator is a combination of two instruments; the bank indicator and the turn indicator. Since you use them together, however, they are housed in one case. The bank indicator consists of a ball free to move back and forth in a tube filled with a special liquid. It shows the relation between angle of bank and rate of turn. When a turn is properly executed the ball will remain in the center of the tube between the two reference lines. If the ball is on the low side you are making a slipping turn, if on the high side a skidding turn. You may use the ball in level flight to determine whether you are skidding or slipping, or if the airplane is properly trimmed.

The standard bank-and-turn indicator shows rate of turn and does not show the amount of turn. A needle width's deflection means that with a properly functioning instrument you are turning at the rate of 180° per minute. This is a standard rate turn used in instrument procedure.

The standard bank-and-turn indicator indicates rates of turn up to 1080° per minute.

The rate of turn is the result of two things—airspeed and angle of bank. The greater the airspeed the greater must be the angle of bank to produce a given rate of turn.

For a one needle-width standard turn (180° in one minute) the following speeds and angles are required:

IAS	Angle of Bank
100	13.5°
150	19.8°
200	25.6°
250	31.0°
300	35.75°

It is obviously impossible to make angle-of-bank readings with sufficient accuracy in instrument procedure turns. But any of the above can be read on the bank-and-turn indicator as a single needle-width turn.

At speeds above 200 mph make only one-half needle-width turns in order to avoid a dangerous angle of bank, providing the instrument has the standard calibration. To read the rate of turn in turbulence average the oscillations of the needle.

DIRECTIONAL GYRO

Use the directional gyro in connection with the magnetic compass. It is not a direction-seeking instrument and, because of precession, must be checked every 15 to 20 minutes against the magnetic compass and re-set.

Set the desired heading by the caging knob underneath the dial.

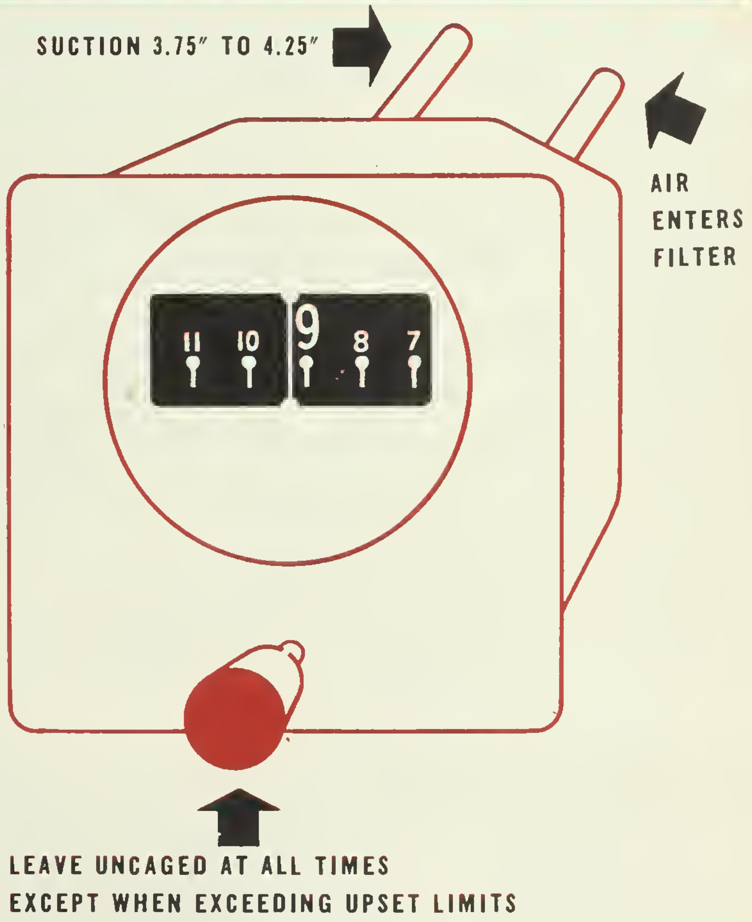
Its approximate upset limits are 55° bank, climb, and glide. When these limits are exceeded the card generally begins to spin; level the airplane, cage the gyro and re-set by reference to the magnetic compass.

The instrument is reliable in turbulence, in contrast to the magnetic compass.

In ground checking the instrument turn the caging knob gently and pull out in one smooth operation. The card should stop and hold its position. This is a check on the rigidity of the gyro. **Do not twist the knob sharply and pull it out at the same time.**

If the instrument drifts off cardinal headings more than 3° in 15 minutes report it on your Form 1A.

Leave the instrument uncaged at all times except in maneuvers which exceed its upset limits.


SUCTION 3.75" TO 4.25"
AIR ENTERS FILTER
11
10
9
8
7
LEAVE UNCAGED AT ALL TIMES EXCEPT WHEN EXCEEDING UPSET LIMITS

GYRO-HORIZON INDICATOR

This instrument indicates realistically the attitude of the airplane.

The upset limits of the instrument are 100° bank and 70° climb and glide.

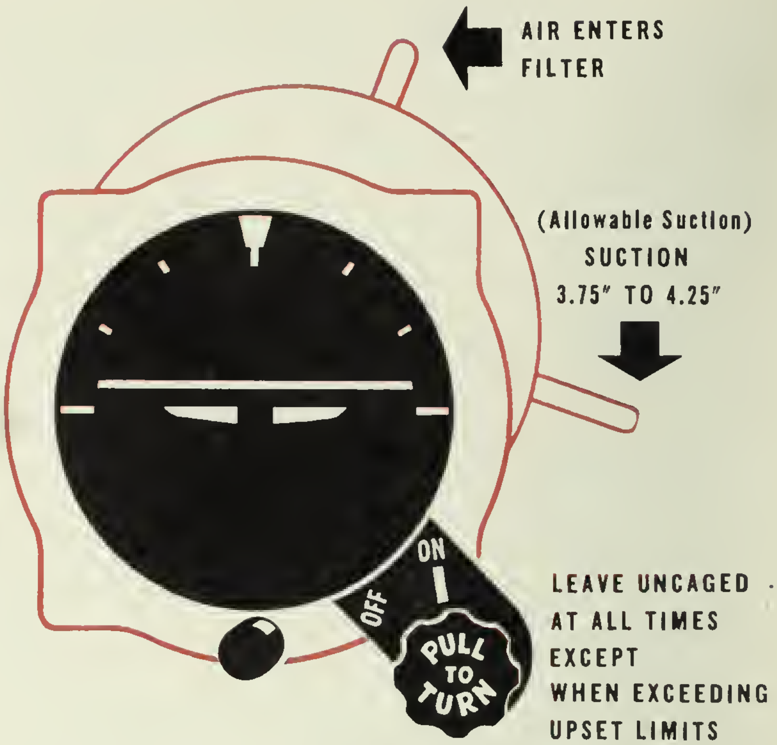
After starting engines allow at least 5 minutes at sufficient rpm before takeoff for the instrument to obtain proper speed. Be sure before takeoff the horizon bar has settled into its proper 3-point position. This may be speeded up by caging and uncaging the instrument after engines are started. **This is the only time the instrument should be caged while on the ground.** Leave it uncaged at all times except in maneuvers which exceed its upset limits.

When caging and uncaging the instrument in flight always make sure the airplane is level both longitudinally and laterally at the moment of uncaging. Always cage the instrument gently to avoid damaging it.

When using the gyro-horizon be sure it is locked in the full ON position (uncaged).

Whenever you make a turn the gyro-horizon develops a small error in indication, known as turn error. After straight and level flight is resumed the error will disappear shortly. Therefore during turns and immediately thereafter refer to the altimeter and airspeed indicator to maintain altitude and compensate for the error in the gyro-horizon.

During flight do not depend solely on the gyro-horizon. Cross-check it with the other instruments.



AUTOMATIC PILOT

Two types of automatic pilots are in general use: suction driven or electrically operated. Operating instructions for each vary widely. Consult instructions for the equipment installed on your airplane, and don't try to operate both types if you are familiar with only one.

In operating either type remember to trim the airplane for hands-off flight before engaging.

Make sure all indices or control indices are in alignment or neutral before engaging the instrument.

Some slight adjustments of the automatic pilot to correct for small changes of load balance are permissible. However, any large change of load balance (such as transfer of fuel, dropping bomb loads, or dropping auxiliary tanks) necessitates your disengaging the pilot and trimming the airplane for hands-off flight before you attempt to use the instrument again.

Don't depend solely on the gyro-horizon indicator unit of the A-3 and A-3A automatic pilot as an attitude reference when flying on instruments. Upset limits of the instrument are low.

WARNING

Never use the automatic pilot for locking the controls while the airplane is parked, or while you are warming up.

AS MAN ASCENDS TO HIGHER ALTITUDES HIS PROBLEM OF SURVIVAL INCREASES

	PRESSURE (Pounds per sq. in.)	OXYGEN PERCENT (Equivalent)	OPENING PARACHUTE SHOCK	PARACHUTE DESCENT TIME (Min:Sec)
45,000 FEET	2.1	3.0		
40,000 FEET	2.7	3.9	33 G	19:55 (50 ft./sec.)
35,000 FEET	3.5	4.9		17:38
30,000 FEET	4.4	6.2		
25,000 FEET	5.5	7.8	26 G	14:07
20,000 FEET	6.8	9.6		
15,000 FEET	8.3	11.8	16 G	7:58 (31 ft./sec.)
10,000 FEET	10.1	14.4		
5,000 FEET	12.2	17.4	11 G	
SEA LEVEL	14.7	20.9		

SECTION 4 MAN GOES ALOFT

EFFECTS OF HIGH ALTITUDE ★

When you ascend into the atmosphere the air pressure drops. The higher you go the less dense the atmosphere becomes. At 18,000 feet the pressure is only 7½ pounds per square inch, or one-half of what it is at sea level. With increasing altitude the air also gets colder, up to 35,000 feet. Decrease in pressure on the body results in:

Oxygen want (Anoxia)
Expansion of trapped gases
Decompression sickness

Oxygen Want (Anoxia)

The air we breathe always contains the same proportion of oxygen—21 per cent. When the air pressure drops, however, the oxygen pressure drops correspondingly. Oxygen pressure is necessary for maintaining the proper amount of oxygen in the blood. At sea level the pressure is sufficient to keep the blood at least 95% saturated with oxygen. This degree of saturation is necessary for peak mental and physical efficiency. When the percentage of oxygen in the blood drops, your efficiency falls off. This condition is known as anoxia or oxygen want.

In flight, oxygen want begins to affect you at altitudes above 5,000 feet. It does not seriously affect efficiency, however, below 10,000 feet, except at night or on long flights. Its effect is so gradual you may not notice it. In fact, you usually feel exceptionally good in the early stages. This is one of the things that makes oxygen want so dangerous.

Unless the deficiency in oxygen is made up, your mind becomes dull; your memory, judgment, and muscular control grow worse and worse; vision and hearing are poor. Fatigue and sleepiness set in; you may have fits of laughing and crying; and finally unconsciousness and even death may occur. Above 20,000 feet anoxia causes most people to lose consciousness within a short time.

The higher you fly, the longer you stay, the more you exert yourself, the more likely you are to suffer anoxia, unless you are wearing your oxygen mask.

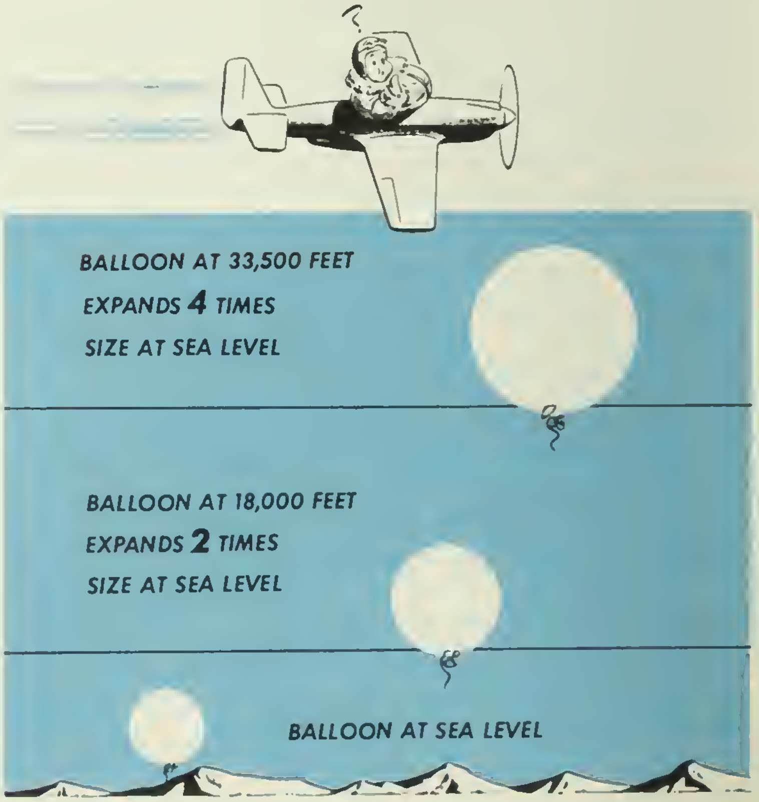
The only way to avoid oxygen want, unless your cabin is pressurized, is to use your oxygen equipment on all flights above 10,000 feet. On all flights of 4 hours or longer use oxygen above 8,000 feet. Don't depend on your feelings. You can't rely on them to tell you when you need oxygen. Regulations require using oxygen any time you fly above an **indicated altitude of 10,000 feet above sea level.** This may not agree with the reading of your altimeter if you have set it to zero for a given field.

If you ever suffer from oxygen want, see your Flight Surgeon immediately afterward.

On night flights you should use oxygen (Auto-Mix "ON" or "NORMAL OXYGEN") from the ground up. This helps improve your night vision. (See PIF 4-6-1.)

Expansion of Trapped Gases

Expansion of body gases occurs in the stomach, intestines, sinuses, and middle ear with increasing altitude. As the outside pressure decreases, these gases tend to increase in volume and cause pain when they can't be released.



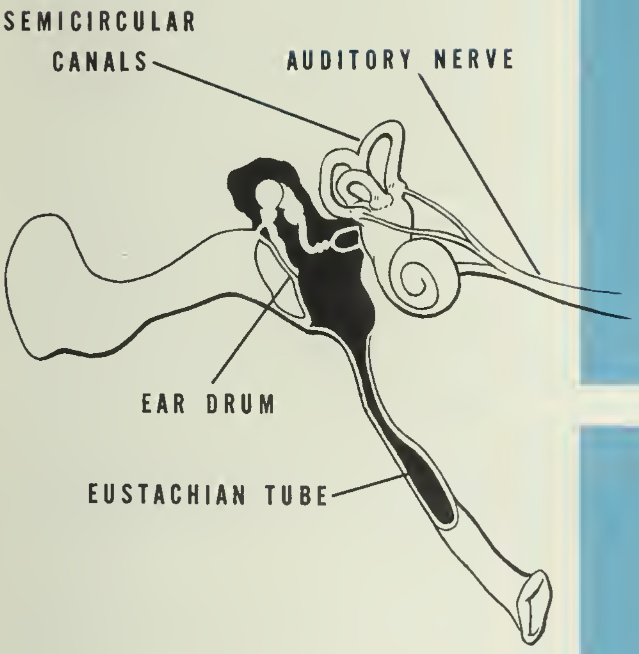
The volume of gas in the stomach and intestines tends to expand these organs like a balloon, and may cause cramps when you ascend to high altitudes. You can obtain relief by belching or passing wind. Otherwise it may be necessary to descend to a lower altitude. Gas troubles can be controlled, at least partially. When you are flying frequently, avoid gas producing food such as beans, cabbage, and carbonated beverages. Remember what foods give you trouble in flight and avoid them. Don't chew gum before or during high altitude flights. You swallow too much air when you chew.

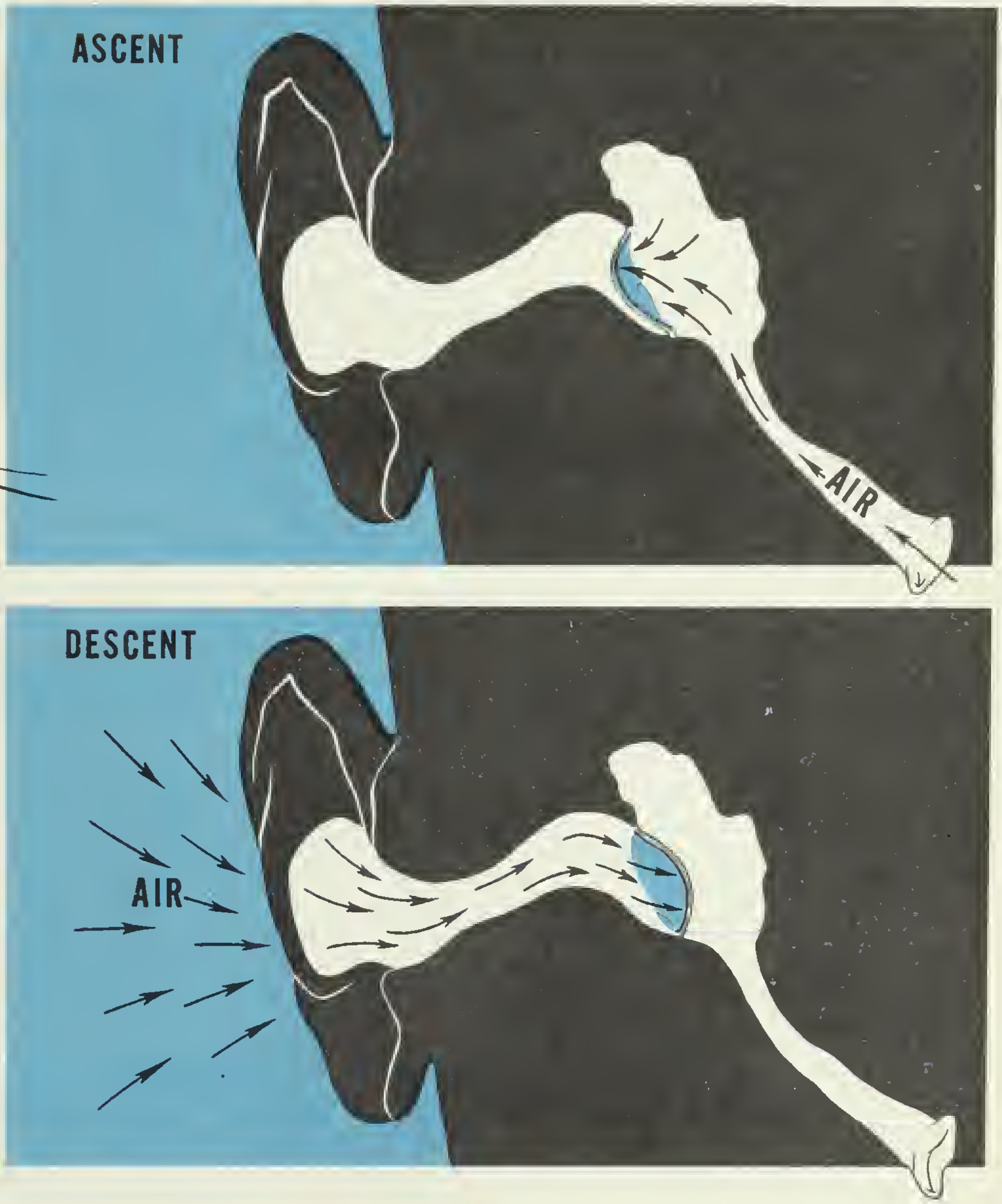
The Ears

The sinuses and middle ear are bony spaces in the head which contain air. These spaces have a moist lining like the nose and mouth. Ordinarily air leaves and enters the sinuses easily by way of small openings into the nose as you ascend and descend. As the air in the middle ear expands it pushes on the ear drum and makes your ear feel full. At intervals while you are gaining altitude the air slips out of the middle ear through a slit-like opening called the Eustachian tube. Each time this opens you hear a click and the pressure is equalized. During descent, however, you must make an effort to clear your ears. You can do this by swallowing, yawning, or pinching your nose and blowing gently with your mouth shut. This lets the air back in and equalizes the pressure. Practice clearing your ears. This will increase the rate of descent you can stand comfortably.

When you have a cold the linings of the sinuses and the Eustachian tube are swollen. It may then be difficult or impossible to clear your ears, and you may suffer great pain as you lose altitude. Your ear drums may even rupture. Pressure changes in the sinuses are also painful. Therefore don't fly when you have a cold, unless it is absolutely necessary. If you have to fly, see your Flight Surgeon first; don't fly at high altitudes; climb and descend gradually.

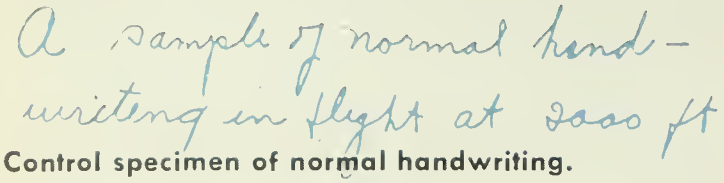
INSIDE THE MIDDLE EAR





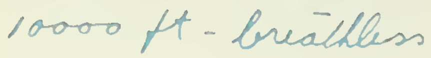
During a climb air leaves the middle ear with comparative ease. During descent you must clear your ears to equalize the pressure; otherwise your eardrums stretch. That's what makes them hurt.

ASCENT TO 25,000 FEET WITHOUT OXYGEN



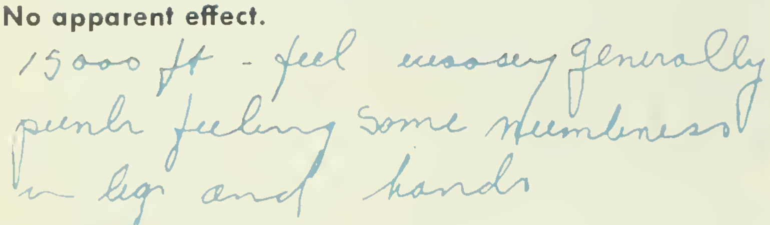
A sample of normal hand-writing in flight at 2000 ft

Control specimen of normal handwriting.



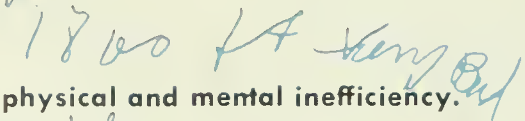
10000 ft - breathless

No apparent effect.



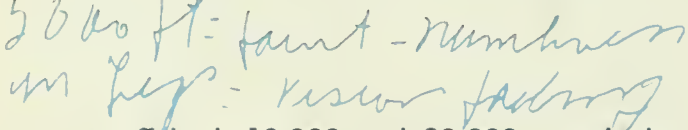
15000 ft - feel uneasy generally punk feeling some numbness in legs and hands

Beginning muscular incoordination.



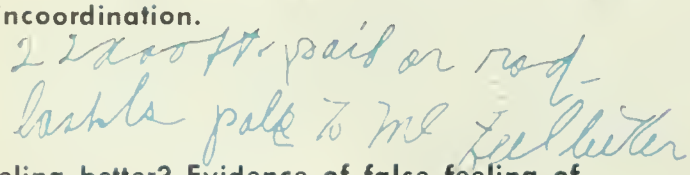
1700 ft - very Bad

Definite physical and mental inefficiency.



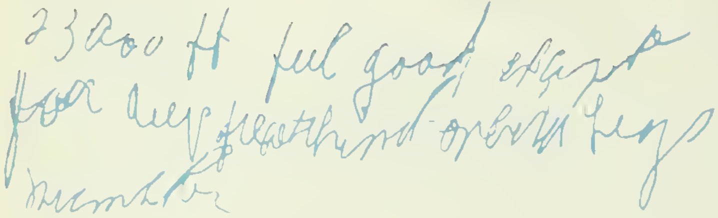
2000 ft - faint - numbness in legs - vision fading

Last zero off both 18,000 and 20,000—marked incoordination.



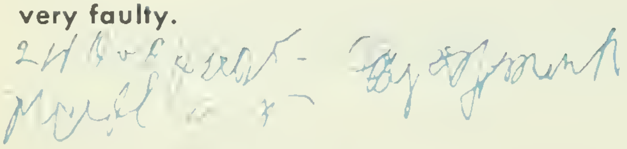
22000 ft - pain on road - [illegible] pale to me feel better

Feeling better? Evidence of false feeling of well-being.



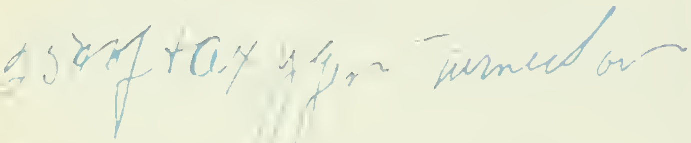
23000 ft feel good except for [illegible] breathing [illegible] legs numbness

Feel good, Insight, judgment and coordination very faulty.



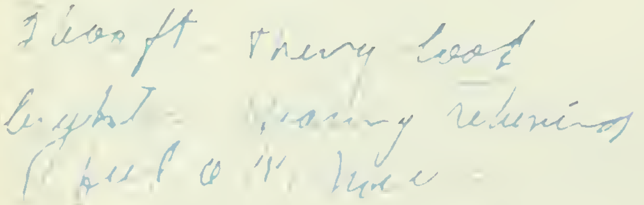
2400 feet - [illegible]

Mental and physical helplessness.



2500 ft [illegible] turned on

Improvement with few breaths of oxygen.



[illegible] ft - very bad sight - [illegible] returning [illegible]

Last zero left off—general improvement, but not completely normal.

Be sure that your oxygen equipment is functioning perfectly, that you know how to use it, that your mask fits properly, and that you know what to do in an emergency. Sudden removal of your oxygen supply at 30,000 feet will produce great mental and physical inefficiency in 30 to 60 seconds and unconsciousness in 30 to 90 seconds.

See your Personal Equipment Officer for proper operation of your oxygen equipment.

Decompression Sickness

Not only do body gases expand when atmospheric pressure decreases, but nitrogen gas in solution in the body tissues tends to escape and form bubbles. This reaction is similar to what happens when you take the cap off a bottle of soda. The pain and discomfort which result are known as **decompression sickness or aeroembolism.**

Trouble seldom develops below 30,000 feet. However, you're more likely to get it the higher you go above this altitude, the longer you stay there, the faster you climb, and the more you exercise. Then the nitrogen in your body forms bubbles, which frequently appear about the joints and in the tissues. Pain results; this condition is called **the bends.** Sometimes a feeling of weight on your chest occurs, together with tightness and pain when breathing. This is known as **the chokes.** Or your skin may feel irritated and begin to itch. This is called **the creeps.**

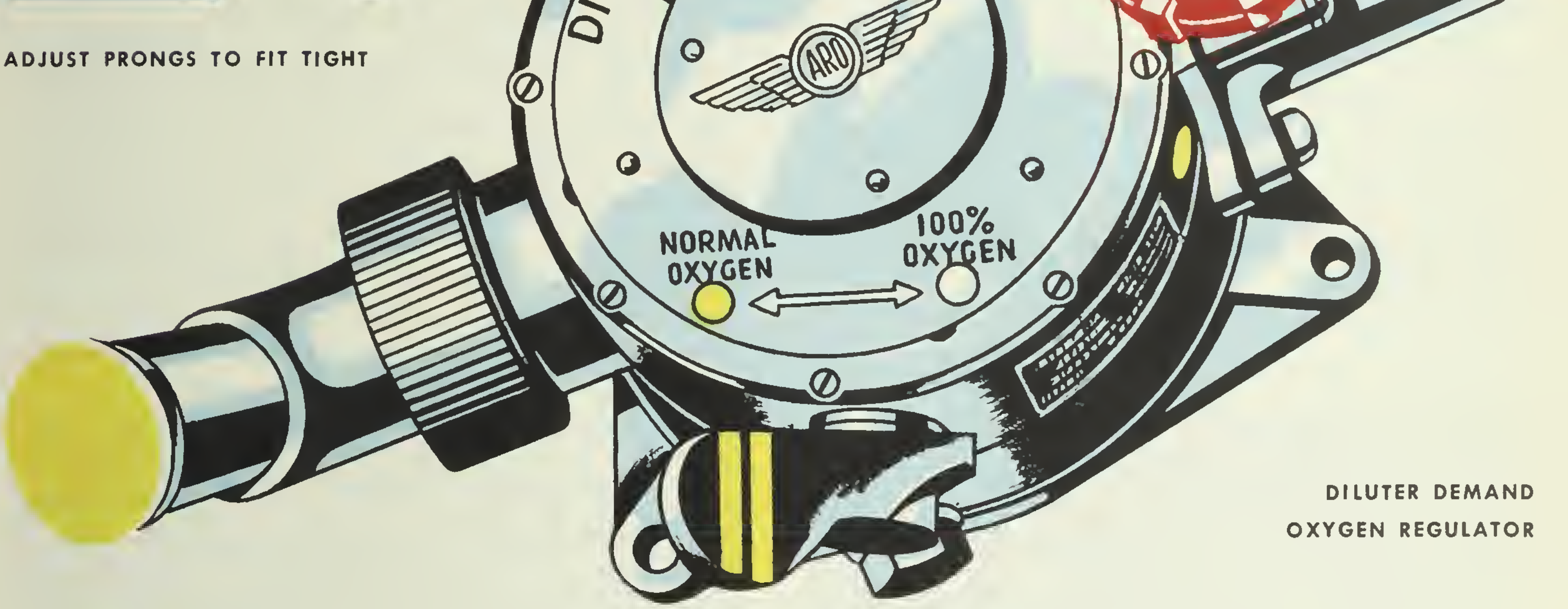
All of these conditions are relieved by descent to 20,000 feet or lower. If you ever have them, see your Flight Surgeon as soon as possible.

Five Golden Rules for Oxygen

1. Use oxygen for all flights above 10,000 feet.
2. Use oxygen from ground up on all night flights.
3. Use oxygen on all flights above 8,000 feet if in excess of 4 hours.
4. Judge your need for oxygen by your altimeter: don't rely on your sensations.
5. Check all oxygen matters with your Personal Equipment Officer.

OXYGEN EQUIPMENT

ADJUST PRONGS TO FIT TIGHT



DILUTER DEMAND OXYGEN REGULATOR

General—Oxygen Systems

Oxygen systems are of two general types:

1. Demand System.
2. Continuous Flow System.

The demand system is automatic. It furnishes oxygen only when you breathe and in just the right amount at each altitude. Every time you draw a breath, oxygen is supplied with the proper mixture of air. All combat aircraft have demand oxygen equipment.

The continuous flow system supplies oxygen in a constant flow. To insure delivery of the proper mixture for each altitude, you must adjust a dial manually on the A-9A regulator to correspond with the altimeter reading. The A-11 regulator, used for passengers, is automatic.

Demand System

The demand oxygen system includes a demand type mask, diluter-demand regulator, pressure gage, and ball or blinker type flow indicator. In addition, a portable recharger hose is supplied at each crew position in heavy bombardment aircraft for recharging portable (walk-around) oxygen equipment from the oxygen system of the airplane.

Two types of demand oxygen masks are available—Type A-10A and Type A-14. They are used with the demand type regulators, the A-12 or AN-6004-1 regulator for permanent installations within the airplane, and the A-13 or A-15 regulator for portable use. The demand regulator is essentially a diaphragm-operated flow valve which opens by suction when you inhale and closes when you exhale. Types A-12 and AN-6004-1 are provided with two manual controls for use under special conditions—

the Auto-Mix or oxygen control lever, and the Emergency Valve.

With the Auto-Mix lever in the "NORMAL OXYGEN" or "ON" position, the A-12 and AN-6004-1 diluter-demand regulators automatically mix just the right amount of oxygen with the air for the altitude at which the plane is flying. This is accomplished by an aneroid control like the one in the altimeter. At sea level the aneroid is fully contracted and the air intake port is wide open while the oxygen port is closed. As the altitude increases and the pressure decreases, the aneroid expands and gradually closes the air intake port. Finally, at an altitude of 30,000 to 34,000 feet the air intake port is entirely closed and the oxygen port is wide open and delivers pure oxygen to the mask.

Remember, the normal position for the Auto-Mix lever is "NORMAL OXYGEN" or "ON." When it is in that position the regulator automatically furnishes the proper amount of oxygen for all altitudes. When the Auto-Mix lever is in the "100% OXYGEN" or "OFF" position, the air intake port is closed and pure oxygen is supplied at all altitudes.

The Type A-15 regulator, for portable use, is not provided with an Auto-Mix lever; the mixing of air and oxygen is entirely automatic.

When the red Emergency Valve knob on the regulator is turned on, the oxygen by-passes the demand mechanism in the regulator and enters the mask in a steady flow, regardless of breathing and of altitude. This valve, therefore, should not be opened except in emergency, as the oxygen supply will be exhausted quickly.

Precautions

Pre-Flight Check:

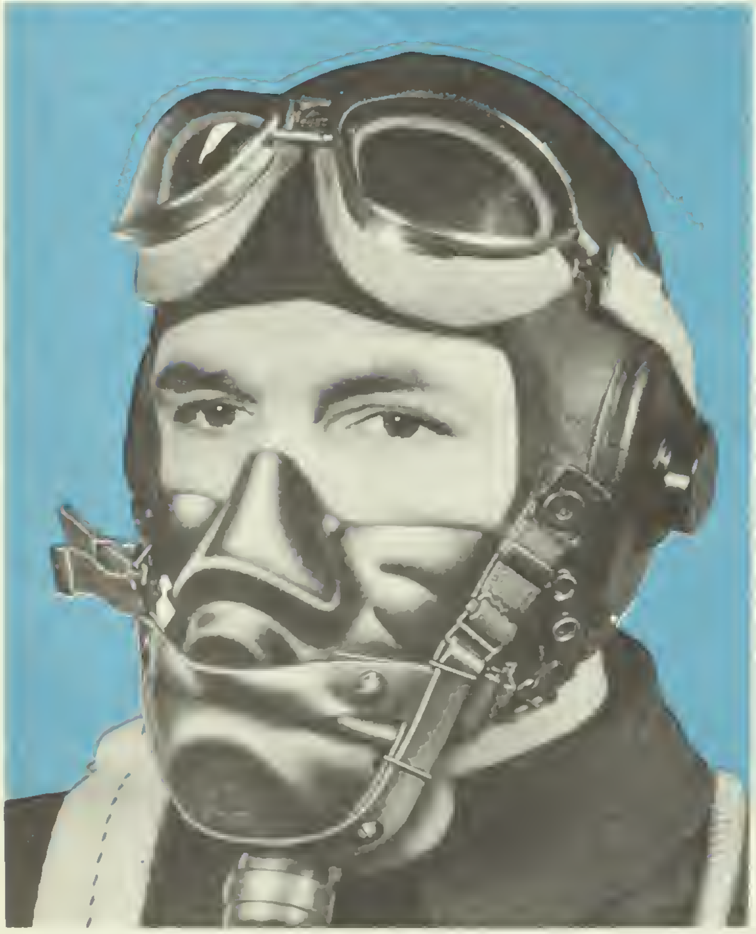
1. Make sure mask fits properly. Check for leaks by holding thumb over end of hose and inhaling gently. Have your Personal Equipment Officer check size and fit with his special test set or Demand Mask Leak Detector, whenever possible.

2. Check the pressure of the oxygen system. It should not be less than 400 pounds per square inch.

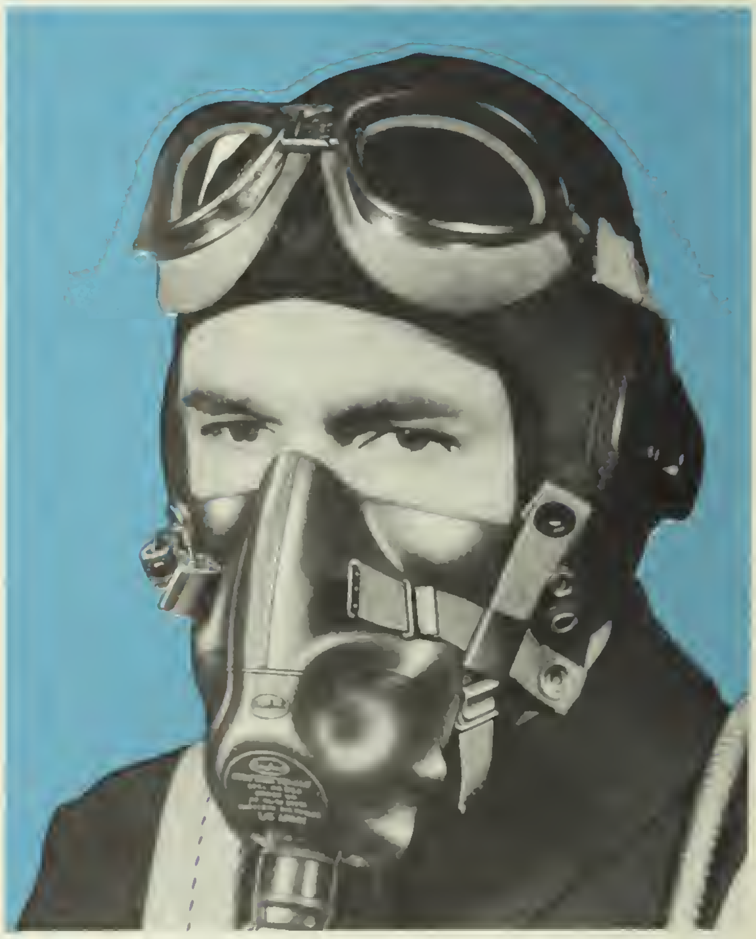
3. Crack the Emergency Valve on the regulator and see that you get a flow.

Caution: When the Emergency Valve is open do not pinch the hose or block the outlet, for this causes the regulator diaphragm to blow out. Then be sure to close the valve tightly.

4. Check knurled collar and hose at outlet end of



A-14 Demand Mask



A-10A Demand Mask

regulator. They should be tight.

5. Check rapid-disconnect fitting on mask hose. Be sure rubber gasket is in place. Make sure male end of fitting fits tightly into the regulator hose. It should withstand a pull of 10 to 20 pounds. Your tubing may have the C-ring type disconnect; if so, check it the same way.

6. Clip oxygen-supply hose to clothing or parachute harness so that it allows movement of head without kinking or pulling the hose.

7. Be sure the Auto-Mix lever is in the "NORMAL OXYGEN" or "ON" position.

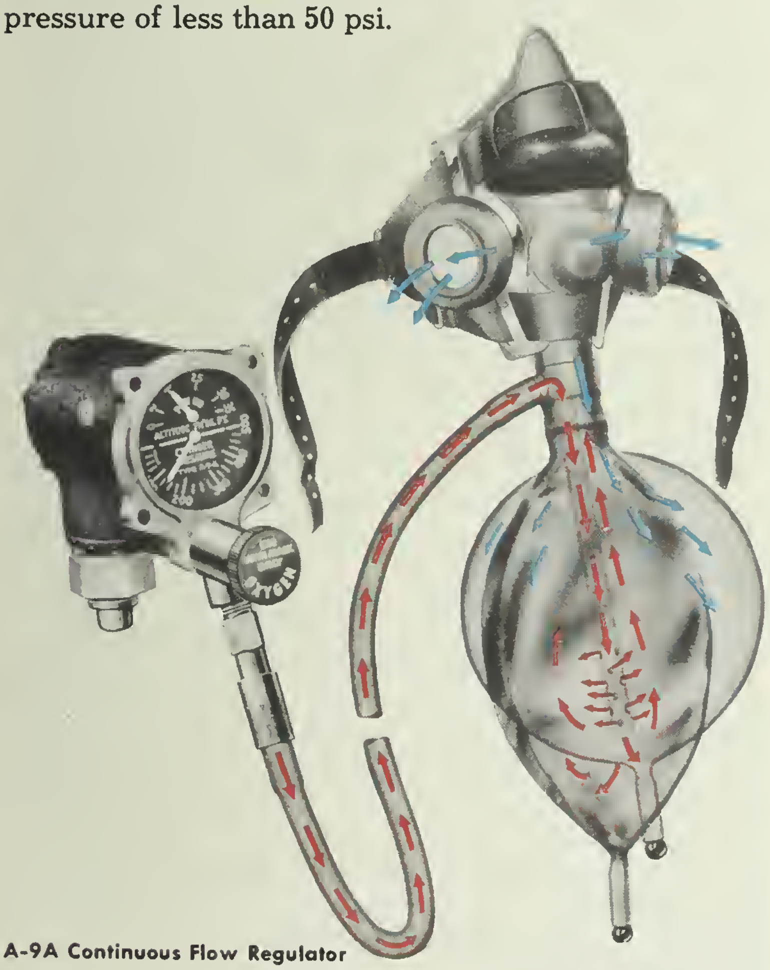
8. Turn Emergency Valve off tight.

In the Air:

1. Check the mask as soon as you put it on, by holding thumb over end of hose, inhaling gently.

2. Manipulate the mask at frequent intervals when the temperature is low, to free it of any ice that may form. Some masks have rubber flap (inhalation baffle) inside to prevent accumulation of moisture in oxygen inlet ports. **Know how to handle your mask if it freezes. Your life depends on it.** If possible, obtain a mask heater or carry an extra mask. See your Personal Equipment Officer.

3. Check the oxygen pressure gage frequently. The regulator does not function properly with a pressure of less than 50 psi.



A-9A Continuous Flow Regulator

A-8B Oxygen Mask

Use the Auto-Mix lever in the "OFF" or "100% OXYGEN" position only:

For the treatment of shock or hemorrhage, at any altitude.
For protection against fumes.
For protection against the bends, if your Flight Surgeon advises breathing pure oxygen from the ground up in special cases.
For symptoms of anoxia.

4. Make a check of the entire crew on the intercom every 3 minutes, to be sure each man's oxygen equipment is working properly.

After a Flight:

Wipe the mask dry. Wash it frequently with soap and water, rinse well, and dry thoroughly. Masks with microphones should not be immersed in water; they should be wiped with a wet cloth.

Inspect mask and hose for cracks and punctures.

Don't lend your mask to anyone except in an emergency.

Continuous Flow System

Some of the older airplanes which do not operate at extremely high altitudes are still equipped with continuous flow oxygen equipment. The A-8B mask is used with the A-9A regulator in the continuous flow system.

The A-8B mask is a re-breather type. The bag helps conserve oxygen from the exhaled air. The mask contains 2 sponge-rubber disks in the turrets of the face piece. When you are exposed to freezing temperatures, squeeze the disks to free them of moisture; otherwise ice may block them.

The A-9A regulator is entirely different from the demand regulators. You get a continuous flow of oxygen by opening the valve until the needle on

Turn on Emergency Valve only:

To revive an unconscious crew member.
If regulator fails. **Watch flow indicator.**
When removing mask at altitude.
If mask slips during a pull-out.
If a hole is shot in the oxygen tube.

To Remove Mask at Altitude

1. Unhook mask on right side, but hold tightly against face.
2. Turn on Emergency flow.
3. Take 3 or 4 deep breaths.
4. Hold breath and drop mask.
5. Don't breathe outside air.
6. Replace mask and start to breathe.
7. Turn off Emergency flow.

You can repeat this procedure, if necessary, but **don't breathe outside air.**

the dial corresponds to the altimeter reading. If you adjust this valve to correspond to the altitude you always get the proper amount of oxygen. During ascent or periods of unusual activity, keep valve setting about 5,000 feet higher than your altitude.

In cargo type aircraft, passengers are supplied from an automatic continuous flow system. In this system the A-11 regulator supplies oxygen for 1 to 15 passengers. Passengers are equipped with A-8B or A-7A masks. See that they plug in to oxygen outlets during flights above 10,000 feet.

Precautions

Maintenance:

Have rate-of-flow checked every 10 days with a ground flow check-meter.

Keep all parts free of oil, grease, and dirt.

Check entire system for leaks. Pressure should be maintained overnight with all regulators in the "OFF" position, if there has been no appreciable change in temperature.

Make sure that the valve adjustment knob of regulator has enough resistance against turning to prevent its being accidentally moved during flight. If it is loose, tighten the valve gland packing nut.

Warning

Be extremely cautious not to contaminate your oxygen equipment with oil, grease, or hydraulic fluid. Fire or explosion may result if even slight traces of oil or grease come in contact with oxygen under pressure.

Be sure that all lines, fittings, instruments, and other parts are free of oil, grease, and other foreign matter.

NEVER USE LUBRICANTS ON ANY PART OF THE OXYGEN SYSTEM

Pre-Flight Check:

1. Check the cylinder pressure. It should show 400 pounds per square inch.
2. Open regulator flow valve wide and be sure needle registers maximum flow.
3. Make sure rubber gasket is present at end of mask hose.
4. Check connections between mask, bag, and connecting tube.
5. Make sure bayonet connection is locked.
6. Check re-breather bag for holes. Be sure plug is in bottom of bag.
7. See that exhalation disks are in place.
8. Carry extra sponge-rubber disks and protective shields for exhalation turrets or a protective fabric bag for entire mask. Take along an extra mask if you go to altitudes above 20,000 feet, in case the one you are wearing freezes.
9. Adjust mask straps for comfortable fit.

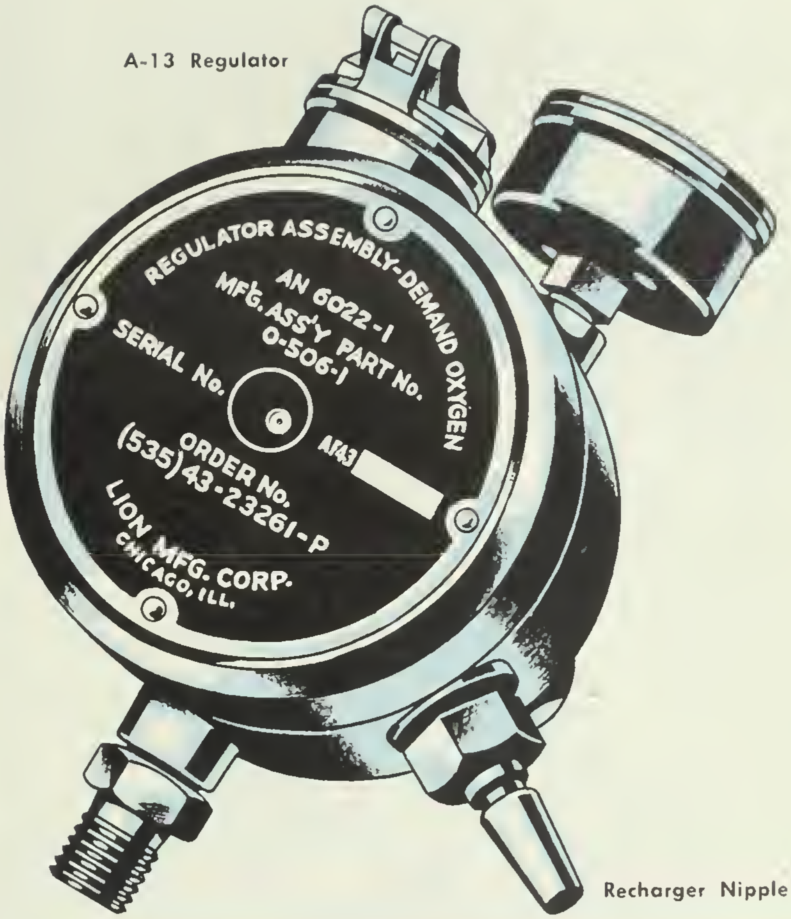
In the Air:

1. Be sure your regulator is set at proper altitude.
2. Check cylinder pressure occasionally.
3. Breathe normally. Over-breathing is dangerous; it may produce dizziness and other serious effects.
4. Put protective shields on exhalation turrets or use the fabric bag whenever the temperature falls below 10°F (–12.3°C). If shields and bag are not available, examine the sponge disks at intervals and remove any ice by squeezing them, or change the sponges.
5. Above 30,000 feet the re-breather bag should never be completely collapsed when you inhale. If it does collapse, open the valve further, no matter what the flow indicator reads.
6. After you change your station at altitude be sure the regulator is properly set and that the bayonet fitting is locked.

After a Flight:

1. Shut all flow valves tight.
2. Wash mask with soap and water, rinse well, and hang to dry.
3. Don't lend your mask to anyone except in an emergency.
4. Keep your mask in a safe place and away from sunlight.

PORTABLE OXYGEN EQUIPMENT



Walk-Around Bottle

Large airplanes are provided with portable oxygen equipment consisting of walk-around oxygen cylinders and regulators. This equipment allows you to walk away from your oxygen station in the plane and provides an emergency source of oxygen.

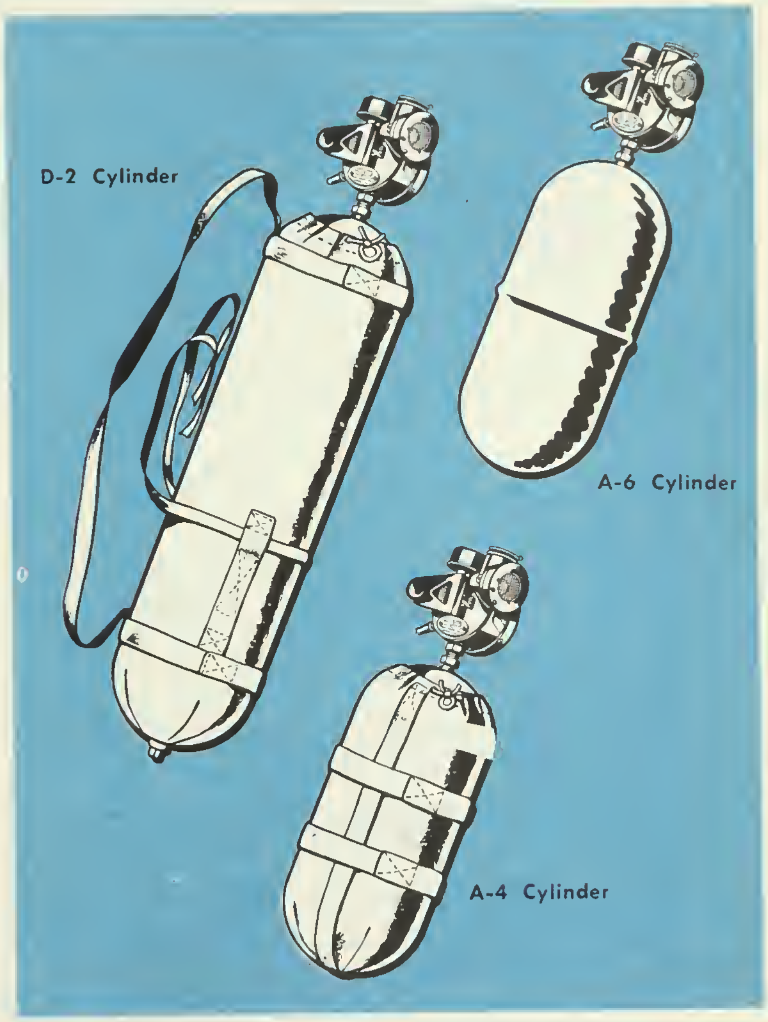
Three types of portable assemblies are in use:

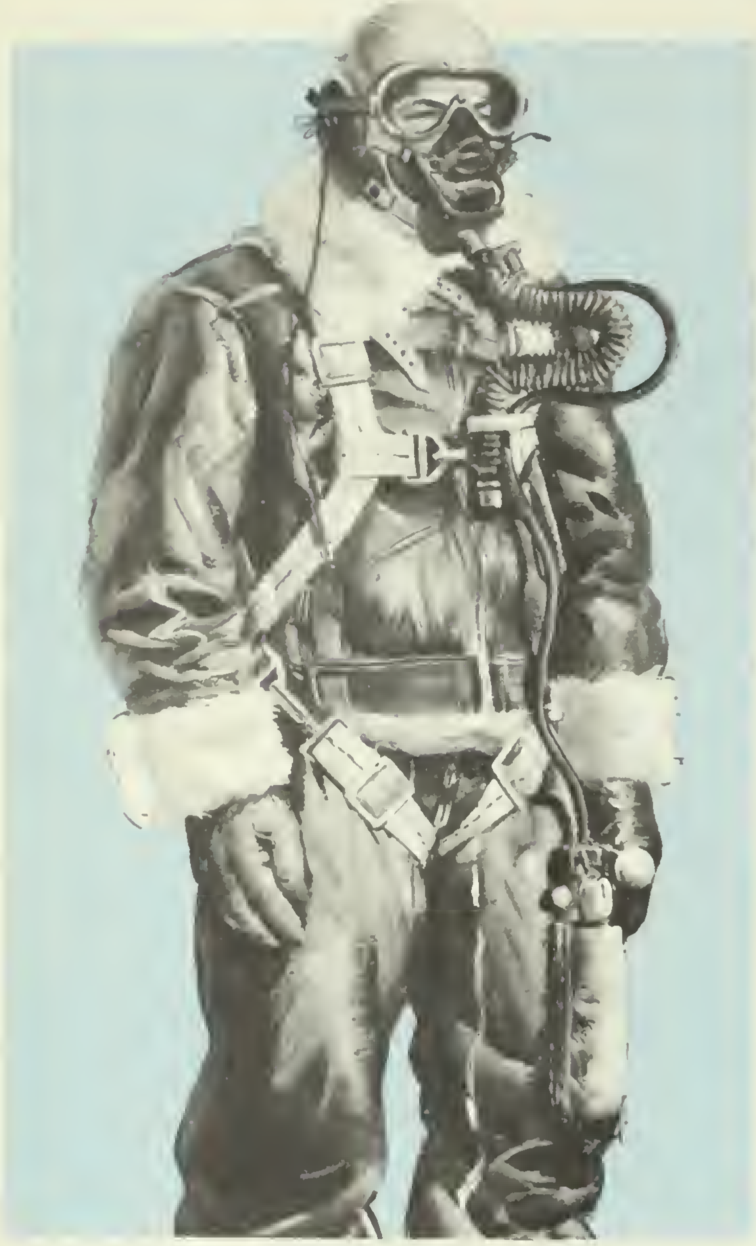
1. The A-4 cylinder and A-13 regulator. Duration of supply, 3 to 8 minutes.
2. The D-2 cylinder, which has a harness for the shoulder, and A-13 regulator. Duration of supply, 20 to 50 minutes.
3. The A-6 cylinder and A-15 regulator, which has clip for attachment to the clothing or parachute harness and an Auto-Mix mechanism (but no lever). Duration of supply, 15 to 40 minutes.

The duration of supply is variable, depending upon the altitude and how much work you are doing. The only safe rule for using walk-around equipment is to watch the gage. Fill your cylinder before take-off and refill it from the plane's oxygen system whenever the pressure falls below 100 pounds per square inch.

To Use the Portable Unit

1. First check the pressure gage to make sure the pressure is at least that of the airplane's oxygen





H-2 Bailout Bottle

system. If it is not, recharge the cylinder by means of the portable recharging hose at each oxygen station.

2. Take a deep breath, hold it, then disconnect mask hose from regulator hose.

3. Quickly lift spring cover on walk-around regulator and plug in tight the male fitting of your mask hose.

4. Now start to breathe again.

5. Fasten unit to yourself by means of clip or shoulder strap.

On all flights above 30,000 feet. Keep your bail-out bottle connected to your oxygen mask. This gives you most protection in an emergency.

Oxygen for Ditching

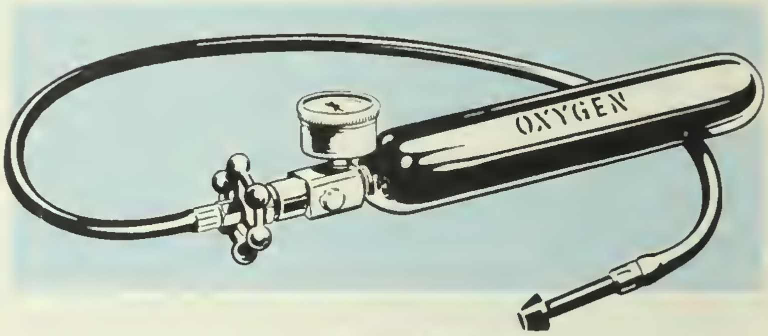
If you have to ditch, prepare for underwater escape from your plane by wearing your oxygen mask connected to your walk-around bottle and A-13 regulator. The duration of the A-4 portable cylinder is short under water, but with the D-2 portable cylinder you can breathe for about 6 minutes at a water depth of 10 feet.

6. Watch for twisting or kinking of hose.

7. **Keep bottle filled! Refill at 100 pounds!**

8. Never leave your oxygen station at high altitude without a walk-around bottle.

BAILOUT OXYGEN CYLINDERS



H-1 Bailout Bottle

Two bailout oxygen cylinder assemblies are available for parachute descents from high altitudes. Both are completely self-contained units with pressure gage and release valve.

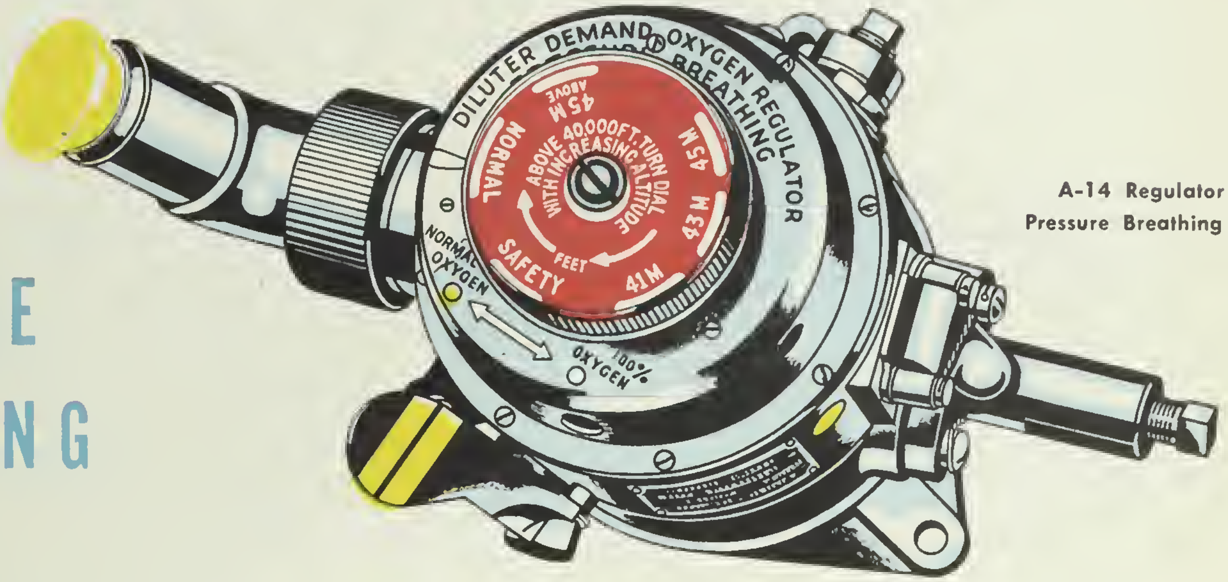
Either cylinder must be tightly fitted and securely tied in a pocket sewn to the flying suit or harness.

Before takeoff, check the cylinder's pressure gage. It should read at least 1800 pounds per square inch. Either cylinder assembly can be used in parachute descents above 30,000 feet, and as an emergency oxygen supply in fighter aircraft if the regular oxygen supply suddenly fails.

Type H-1: Before jumping, grip pipe stem between your teeth and completely open flow valve.

Type H-2: Before jumping, pull the release to open flow valve. Then, disconnect the main oxygen tube and tuck it inside your jacket. If this is impossible hold your left hand over the free end. Then jump, keeping free end of main oxygen tube covered until parachute opens.

PRESSURE BREATHING


DILUTER DEMAND OXYGEN REGULATOR
PRESSURE BREATHING
NORMAL
SAFETY
41M
43M
45M
45M ABOVE
ABOVE 40,000 FT. TURN DIAL WITH INCREASING ALTITUDE
FEET
NORMAL OXYGEN
100% OXYGEN

A-14 Regulator
Pressure Breathing

Pressure demand equipment increases your safe ceiling. With it you have a greater safety factor between 30,000 feet and 40,000 feet. The extra pressure compensates for possible small leaks in your mask fit and insures your getting 100% oxygen. Breathing out against pressure takes a little effort, but you get used to it quickly.

With pressure demand equipment you can safely fly as high as 43,000 feet. In emergencies you can go even higher for brief periods.

The pressure demand oxygen system is the same as the regular demand system, except for the regulator and mask.

The Pressure Demand Regulator Type A-14 is a Type AN-6004-1 diluter demand regulator to which a spring-weighted diaphragm has been added for pressure breathing.

The Pressure Mask, Type A-13A or A-15, is a special one which must be used for pressure breathing. It can be used with some regular demand regulators (Aro type), but a regular demand mask cannot be used for pressure breathing.

The Flow Indicator. Without pressure breathing the blinker works the same as with the regular demand system. With Safety Pressure or Pressure Breathing, the blinker may not work.

How to Use Pressure Demand Equipment

Below 30,000 Feet:

Use regulator just like regular demand regulator. It can be used with regular demand mask or with pressure breathing mask. With regular demand mask, you can obtain an Emergency flow by turning the Pressure Dial on the regulator.

Above 30,000 Feet:

Use regulator for pressure breathing by turning dial clockwise. The regulator gives you 100 per cent oxygen on demand. The farther you turn the dial the greater the flow pressure of oxygen.

How to Use Dial Control

Below 30,000 feet, keep setting on "NORMAL."

Between 30,000 feet and 40,000 feet put setting on "SAFETY."

Between 40,000 and 41,000 feet, set dial to "41M."

Between 41,000 and 43,000 feet, set dial to "43M."

Between 43,000 and 45,000 feet, set dial to "45M."

Above 45,000 feet, set dial to "45M ABOVE."

To be safe, always have the dial setting slightly higher than the altimeter reading.

Check Your Mask Before Each Flight

1. Do a suck test, as with regular demand mask, holding thumb over end of mask tube. This tests the fit and the exhalation valve. When you inhale, the mask should be sucked in toward your face.
2. Hook up mask to regulator, turn dial up to give oxygen under pressure, and hold your breath. Oxygen should stop flowing into mask. If it keeps flowing, check mask fit and exhalation valve.
3. Now breathe with oxygen under pressure to be sure you can exhale easily. If you can't, check with your Personal Equipment Officer.
4. Clean mask periodically with a wet cloth.

Reference: T.O. No. 03-50-31

Don't use pressure breathing below 30,000 feet. It wastes oxygen. Below 30,000 feet keep Auto-Mix Lever on "NORMAL OXYGEN" and the dial setting on "NORMAL."

OXYGEN EMERGENCIES

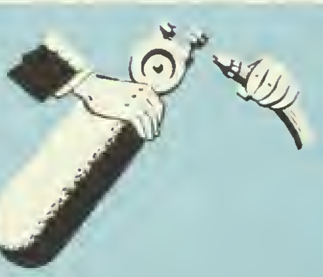
If crew mate is unconscious:

1. Make sure of your own oxygen supply.

2. Check his mask-to-regulator connections carefully.

3. Check his oxygen cylinder pressure.

If pressure is below 50 psi:

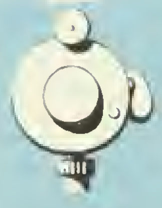


1. Connect his mask to walk-around bottle.

2. Keep his bottle filled from yours or from another recharger hose.

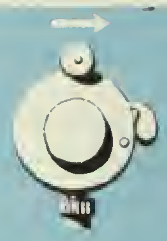
3. Check his mask for possible leaks or obstructions.

If pressure is above 50 psi:



1. Open his Emergency Valve (with pressure demand regulator, set dial on SAFETY).

2. Check his mask for any leaks or obstructions.



3. When he comes to, turn the Emergency Valve off.

If he still doesn't come to, check these points:

1. Breathing (Give artificial respiration; PIF 8-14-4).

2. Bleeding (Apply local pressure or tourniquet).

3. Can you fly lower?

DANGEROUS GASES

The air you breathe while in flight should be free of all other gases except the oxygen from your mask. Exhaust gases, gasoline vapors, hydraulic fluid fumes, smoke, or poison gas may contaminate the cabin air. In sufficient concentration, any of these is dangerous. You can protect yourself from them by knowing when to suspect their presence and by observing the necessary precautions.

Exhaust Gas

Exhaust gas is a mixture of several substances. Among them are carbon monoxide and oxides of nitrogen, both of which are poisonous. In exhaust mixtures, carbon monoxide is the more important, for it is present in larger amounts. Carbon monoxide acts by combining with the red cells of the blood and making them useless for carrying oxygen to the body tissues. This results in oxygen want or anoxia. As you ascend from sea level the dangers resulting from carbon monoxide increase, even below 10,000 feet, unless you use your oxygen mask.

In Flight:

The effects of carbon monoxide poisoning are similar to those caused by oxygen lack—shortness of breath, headache, nausea, dizziness, dimming of vision, poor judgement, weakness, unconsciousness, and death. The higher the concentration of the gas, the longer you breathe it, the higher the altitude (unless you use your oxygen mask), and the greater your activity, the more severe are the symptoms.

Like anoxia, carbon monoxide poisoning may give no warning. The gas itself has no odor, but you can be pretty sure of its presence if you smell exhaust gas. **The only safe rule for protecting yourself against carbon monoxide in flight is to wear your oxygen mask with the Auto-Mix in the "OFF" or "100% OXYGEN" position whenever you smell exhaust gases. In this way you get pure oxygen to breathe and are completely protected from any gases in the cockpit. As soon as you safely can, land your plane and report the trouble to your Engineering Officer.** If you had any unpleasant sensations during flight see your Flight Surgeon as soon as possible.

Don't use your exhaust heater during combat. Enemy gun fire may cause dangerous leaks of exhaust gas into the cabin.

On the Ground:

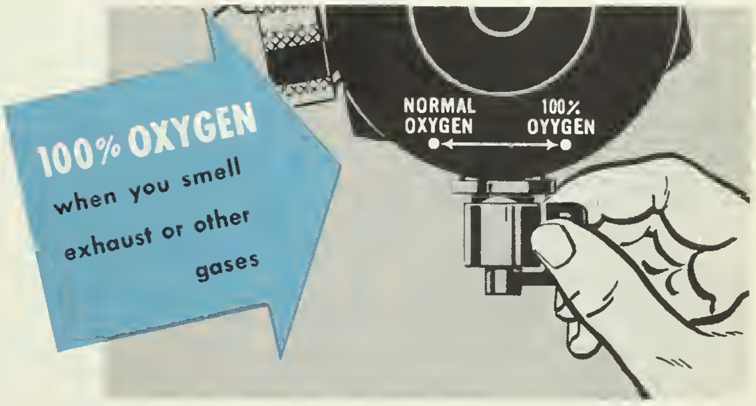
Carbon monoxide is always present in poorly ventilated hangars and garages when engines are running. Therefore, don't run any kind of engine longer than necessary inside closed hangars and garages. Ventilate such places as much as possible. If the doors must be kept closed, don't stay inside any longer than necessary.

In cold regions, where gasoline or oil stoves and lamps are used in closed buildings or tents, carbon monoxide is formed whenever fuel is burned. Cross-ventilation is your only reliable protection.

Gasoline Vapors

Gasoline vapors in aircraft cabins may cause serious trouble. Aviation gasoline contains special compounds which make its vapors more dangerous than those of ordinary gasoline. One gallon produces 30 cubic feet of vapor at sea level. These vapors are heavier than air.

Breathing gasoline vapors is harmful because the vapors are easily absorbed by the lungs. Even one-tenth of the concentration of gasoline vapor which is necessary to support combustion is dangerous if inhaled for more than a short time. Symptoms may include dizziness, nausea, headache, burning and watering of the eyes, restlessness, excitement, disori-



entation, disturbances of speech, vision, and hearing, convulsions, and unconsciousness.

One gallon of gasoline produces 1600 cubic feet of explosive vapor at sea level and has the blasting power of 83 pounds of dynamite.

If a gasoline leak occurs in your airplane, or if any occupant smells gasoline vapors during flight:

Leave all electrical and radio equipment switches just as they are; the slighest spark may cause an explosion.

Ventilate the cabin if possible.

Have crew and passengers put on oxygen masks with Auto-Mix in "OFF" or "100% OXYGEN" position. This excludes contaminated air from the lungs.

Have all aboard stop smoking; put on goggles, if available, to protect eyes from irritation;roll down sleeves and put on gloves, helmet, and other articles of clothing for protection against burns in case of fire.

Hydraulic Fluid Vapors

Some types of hydraulic fluid contain substances which are dangerous when their vapors are inhaled. They cause irritation of the eyes and breathing passages, headache, dizziness, and disturbances of judgement and vision. These harmful effects are increased by altitude or by high temperatures. Use your oxygen mask with Auto-Mix "OFF" ("100% OXYGEN") if hydraulic fluid leaks into the cockpit.

A spray of hydraulic fluid ignites easily and spreads its flames rapidly. Be on guard against fire if a hydraulic leak occurs.

Smoke

Smoke may arise in the airplane from a variety of sources such as hot oil fumes, a break in the coolant fluid lines, or from signal flares. Some types of smoke are dangerous to breathe, but all smoke will irritate your eyes and throat and make you cough. Don't take chances. Wear your goggles and use your oxygen mask with the Auto-Mix "OFF" and breathe 100% oxygen until you clear the cabin of smoke.

Poison Gas

The poison gases which were known at the end of the last war are all heavier than air and tend to collect near the ground. Most of them have a distinctive odor:

Phosgene and Di-Phosgene (Odor of musty hay or decaying leaves).

Chlorpicrin (Sweetish smell, like licorice).

Mustard gas (Smells like garlic or onion).

Lewisite (Geranium-like odor).

Accurate identification of these gases may be impossible, because of the use of mixtures or of newly developed agents. Most of them cause irritation of the eyes and lungs.

A gas mask, of course, is the ideal protection against these poisons. When a gas mask is not available, your oxygen mask, together with goggles, provide the best type of protection. But be sure to keep the Auto-Mix "OFF" ("100% OXYGEN").

Phosgene is formed when the carbon tetrachloride in your fire extinguisher comes in contact with fire. Ventilate aircraft thoroughly after extinguishing fire, to avoid unnecessary exposure to phosgene, or protect yourself by means of gas mask or oxygen mask. (See PIF 8-12-3).

First Aid

If a man is overcome, begin first-aid at once:

1. Remove him from the source of the gas.
2. Give him pure oxygen to breathe, if available (turn on Emergency flow).
3. Begin artificial respiration immediately (See PIF 8-14-4).
4. Keep him warm.
5. Send for a Medical Officer.
6. Never exercise a person who has been overcome by gas. This only makes him worse.

References: AAF Ltr 62-9 AAF Reg. No. 55-20

SMOKING IN AIRCRAFT IS PROHIBITED

During all ground operations.

During and immediately after takeoff.

During fuel transfer operations.

Immediately before and after landing.

Any time any occupant detects gas fumes.

In bomb bay or fuselage section containing auxiliary gas tanks.

In the passenger compartment of C-87 type aircraft at all times.

In the C-54 type aircraft when fuselage tanks are installed.

At any time or place whenever aircraft commander deems such action necessary for safety.

PHYSICAL FITNESS

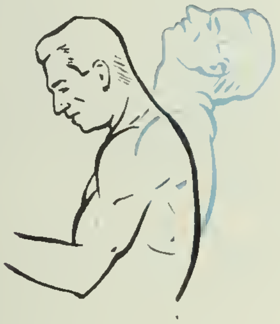
You are responsible for the physical fitness of yourself and your crew. Good food, sufficient sleep, rest, and relaxation are important. Regular exercise, every day if possible, is essential.

Make an effort to have your entire crew participate in a regular athletic program. Touch football, basketball, soccer, speedball, volleyball, softball, and baseball are excellent forms of athletics which stimulate teamwork as well as provide necessary exercise. If you can't round up enough men for these games, play badminton, tennis, handball, squash, or medicine ball. If alone keep in condition by swimming, weight-lifting, rope-skipping, cross-country running, or any of the calisthenics or setting-up exercises you learned during your training period.

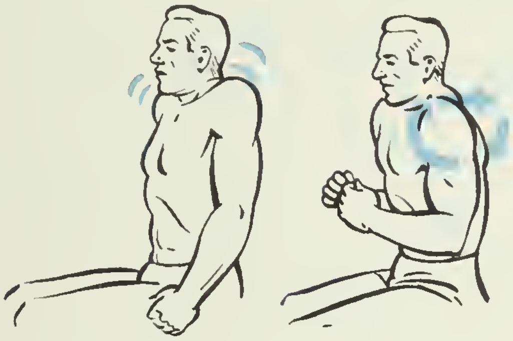
The important things are to exercise regularly and to get the most fun and relaxation when you do. Check up on your physical fitness from time to time by giving yourself the work-out prescribed in the AAF Physical Fitness Test. The test is simple, practical, and specific. You and your crew can find out how close you are to top physical condition by comparing yourselves with the standards.

During Flight

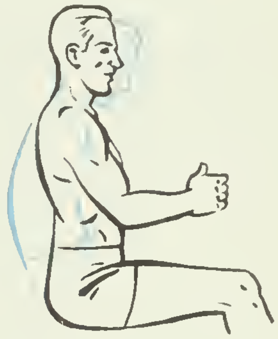
Your body becomes tired and you are less alert after remaining in one position for several hours during flight. A few simple exercises, done periodically, will break the monotony, help relieve that tense, aching feeling, and keep you more relaxed. When cruising on long flights, have your crew do these exercises every hour.



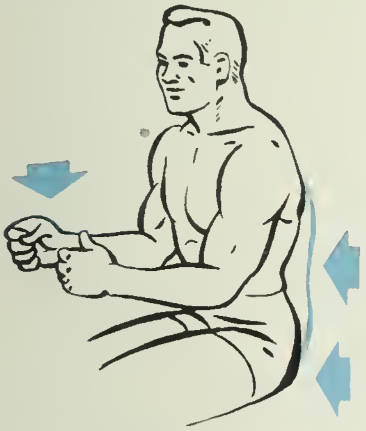
NECK: Move head backward, squeezing muscles back of neck —Hold it—Relax.



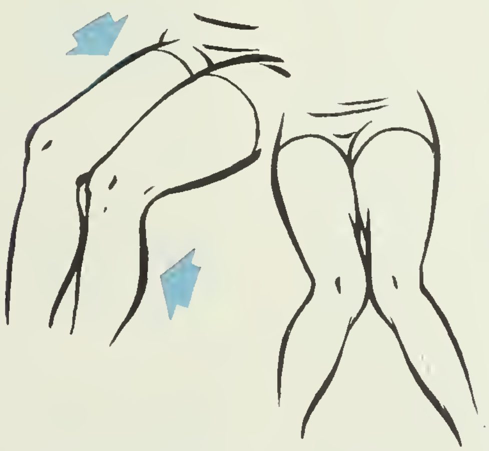
SHOULDERS: Shrug shoulders—Hold it—Let go. Now move shoulders forward, up, back—Hold it—Let go.



BACK: Arch back—Hold—Let go.



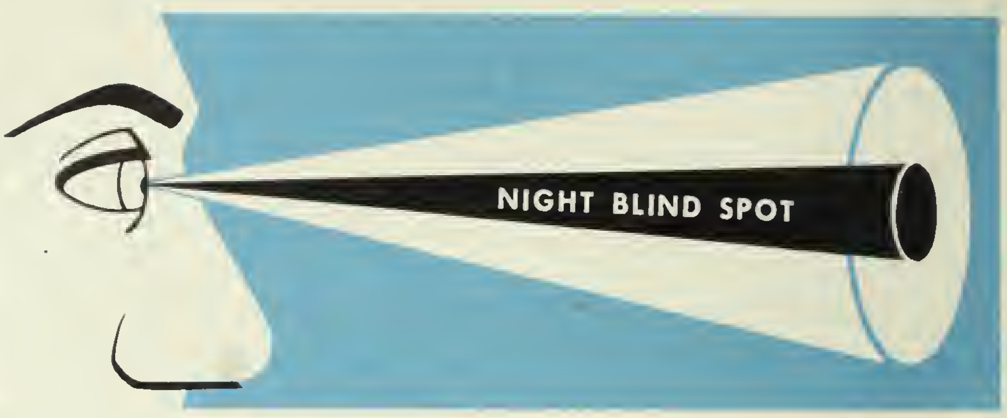
ARMS, ABDOMEN, AND BUTTOCKS: Clench fists and tighten muscles of buttocks, pressing lower back against back support—Hold it—Let go.



LEGS: Tighten leg and thigh muscles—Hold it—Relax. Now move knees close together—Hold it—Relax.

Take time for exercise daily. Good physical condition is essential to combat efficiency. It increases your resistance to anoxia, the bends, cold, and blackout, and betters your chances for survival under emergency conditions.

VISION AT NIGHT



Some animals see as well at night as during the day. Man cannot. But your efficiency in night flying and your effectiveness in night combat depend on your night vision. Learn how to improve it.

Night vision differs from day vision. In daylight the center of the retina, or lining of the eye, is the most sensitive part of the eye. At night, however, the center of the retina can't see at all. It is called the night blind spot. In dim light the off-center parts of the retina are most sensitive. Try it. You see best at night when you look slightly off-center or to the side of the object you wish to see. The off-center parts of the retina also detect movement more easily than does the central part.

When searching the sky, earth, or surface of the sea at night, the most effective and simplest method is scanning. Keep your line of sight fixed in one direction for about a second. Then move your eyes or head in jumps of 10 to 20 degrees, as in reading a book, and pause for a second or two at the end of each jump. In this way you cover the entire field in a series of eye or head movements and pauses.

If you remain in a dark room your eyes gradually see things which they could not see at first. This is known as **dark adaptation.** By adapting your eyes to darkness you increase their sensitivity 10,000 times; that is, after only 30 minutes in the dark you can see a light 10,000 times dimmer than any you could have seen in bright light. You can also adapt your eyes in a light room by wearing red-lensed goggles. It takes a half-hour to adapt to dark, but you lose your adaptation temporarily by exposing your eyes to bright light for only a brief period.

The retina is highly sensitive to oxygen lack. So on all night flights, except low altitude training missions, **use oxygen from the ground up.** It pays.

Ability to see at night depends upon your body's content of Vitamin A, obtained chiefly from eggs, butter, milk, cheese, liver, carrots, squash, peas, apricots, and peaches. Eat them liberally.

Dirt, oil, and scratches on your windshield, goggles, or windows make night vision more difficult. They scatter light and produce glare. Keep your goggles and windshield scrupulously clean and free of scratches.

Aids to Night Vision

Adapt to the dark. Stay in a dark room or wear red-lensed goggles. (Goggles, Assembly, E-1, Class 13, Stock No. 8300-331450) for a half-hour before any night operation.

Protect your adaptation. Don't expose your eyes to bright lights before takeoff or during flight, either inside or outside airplane.

Avoid lights. Keep all non-essential lights in plane turned out and dim all essential lights.

Make readings fast; then look away. Don't look too long at lighted instrument panel or charts. Or use only one eye; the other will retain its dark adaptation.

Use red light in the cockpit, if possible. But remember then that red lines will not show as red on your charts.

Use **oxygen** from the ground up on night flights.

Keep windshield, windows, and goggles clean and free of scratches.

Avoid looking at white paper or other white objects; they reflect light.

Prevent cockpit light reflection on windshield. Use horizontal hood over instrument panel if needed.

Practice off-center glances at night.

Get enough Vitamin A. Eat the proper foods.

Don't Stare at Night

If you stare at a light in a dark room, you soon think the light has begun to move. The same thing happens when you stare at a light outside the cockpit while flying at night. Don't stare at the tail light of your lead plane when flying formation at night. You may go into a dive without knowing it.

CLIMATE AND HEALTH

The AAF has circled the earth. Its flying operations are conducted over every type of terrain, desert, jungle, and Arctic, where the temperatures range from higher than 130°F to lower than –50°F. Each region presents special problems in living. Learn what they are and how to cope with them.

WARM CLIMATE HEALTH

In warm regions such as the tropics, desert, or jungle several weeks may be required for your body to become completely adapted to the heat. During this period protect yourself from sunstroke or heatstroke by following a few simple rules.

Clothing

During the daytime protect yourself from the severe burns which may result from exposure to the intense rays of the sun. Wear a cap or sun helmet and lightweight clothing which exposes as little of the body as possible. Clothing should be loose and porous to permit evaporation of sweat. This helps cool you. Get in the habit of shaking out your clothes before putting them on, so as to rid them of flies, insects, and snakes. Tinted goggles or sunglasses protect your eyes from the glare of the sun; also from dust and sand. Protect exposed areas of body with sunburn protective ointment.

Don't sunbathe right away. It's dangerous, unless you develop a tan gradually. A good plan for sunning yourself is 5 minutes' exposure the first day, increased by 5 minutes each day until you are thoroughly tanned. Don't get burned!

Although the temperature may be intensely hot on the ground, the air is cooler the higher you climb; at high altitudes it is extremely cold. So be prepared to add or remove clothing according to the temperatures you encounter.

Even on the ground, nights are frequently cold in the desert. Anticipate rapid changes in temperature by having warm clothing available at night. Woolen socks are best for general use; they provide the greatest comfort because they absorb moisture well and are good insulators. Wear GI shoes. They keep out sand and protect your feet better than oxfords. You can also walk home in them.

Water and Salt

If your water supply is limited, you must use it sparingly. With care you can get along on surprisingly little.

Keep physical exertion at a minimum. Exertion makes you sweat; sweating makes you thirsty. Stay out of the sun as much as possible. Do your heavy work in the shade and during the cooler hours of late afternoon, evening, or early morning. Cut down on your smoking as it makes you thirsty; chew gum instead. Rest as much as possible, and take advantage of the breeze. Go easy on alcoholic drinks. They increase your body's need for water.

If you find yourself sweating heavily, salt your food liberally at meals to help make up for the salt lost through sweat. Your Flight Surgeon may advise taking salt tablets in addition. Check with him on the dosage, for salt tablets may do more harm than good if your water ration is limited.

If your body loses too much salt through sweating, you may get **heat cramps** in your muscles.

Sunstroke is usually caused by prolonged exposure to the direct rays of the sun, although it may occur even in cloudy weather. It is a serious condition. Symptoms may include headache, dizziness, red spots before the eyes, and vomiting.

Heatstroke is a similar condition resulting from exposure to excessive heat from any source.

All of these conditions can be prevented by avoiding sun, sweat, toil, and salt-loss as much as possible. A victim of sunstroke or heatstroke must have prompt treatment. Give him a bath in cold water, cover with wet sheets, or simply pour cold water over his clothes and fan him.

Disease

In the tropics and desert, certain diseases are usually present. Know what they are, how they are transmitted, and precautions to take, so you can avoid getting them. Guard constantly against:

Insects
Contaminated food and water
Breaks in the skin's surface

Insects

Mosquitoes in the tropics are your greatest danger. They transmit malaria, yellow fever, dengue, and other diseases which can lay you low as surely and effectively as an enemy bullet. Mosquitoes breed in water. They usually rest in the shade during the day and bite at night. In dense jungles or dark rooms, however, they may bite during the day.

Keep yourself covered at night. Wear long trousers, sleeves, gloves, and headnet. Smear exposed surfaces of the skin, such as your face and neck, with mosquito repellent every 3 or 4 hours during late afternoon and night. Apply carefully, as mosquitoes will find and bite every small untreated spot even though it is completely surrounded by repellent. After dusk stay away from native villages and swamps. In heavily infested areas, wear clothing which has been treated with mosquito repellents.

Sleep under a bednet. Inspect and spray inside it to kill mosquitoes before entering. Tuck net under blanket or mattress. Keep it mended.

Use mosquito spray (Aerosol or DDT) liberally in your tents and buildings.

Malaria. This is one of the most widespread diseases in the world. It is a major military problem in South America, the Indies, Africa, the Middle East, India, Burma, Thailand, Indo-China, China, and Malaya. It is carried by the anopheles mosquito, which injects the malarial parasite into your blood.

The disease takes different forms with symptoms appearing about 2 weeks after infection. You may then experience headache, chills, fever, and other symptoms, depending on the type and severity of the disease. Prevention of malaria is largely up to you. Don't give the mosquitoes a chance. In certain regions you may be advised to take atabrine to help prevent malaria. If so, take it regularly, according to local directives and the instructions of your Flight Surgeon.

Other diseases transmitted by mosquitoes include:

Yellow Fever. Confined at present to Eastern and Central Africa and the bulge of South America. Vaccinations against this disease protect you.

Dengue (Breakbone fever) occurs in tropical regions, chiefly at the end of the rainy season. Symptoms consist of muscle and joint pains, backache, fever, and rash. The mosquito which transmits it bites mostly during the daytime. You must protect yourself from it to avoid the disease.

Besides mosquitoes there are other pests you should steer clear of:

Flies. They breed in filth and transmit the germs of dysentery and typhoid from human waste to your food. Protection against flies requires screening of latrines and kitchens, proper disposal of garbage, and frequent spraying with Aerosol or DDT. Special types of flies may transmit other diseases, such as sand-fly fever, yaws, and sleeping sickness.

Mites. Small six-legged insects about the size of a pinhead, sometimes known as red bugs or chiggers. They transmit typhus or scrub typhus (Tsutsugamushi fever). This disease is prevalent in the Southwest Pacific and the China-Burma-India theater. It results in headaches, chills, and fever. Cover the body, avoid sleeping on the ground, and wear clothing impregnated with anti-mite fluids or insect repellents, for protection.

Lice. They carry the germs of typhus fever and relapsing fever. Lice hide in the seams of dirty clothing and spread from one person to another. Boil infested clothing or sterilize with chemicals.

Fleas. Most fleas are harmless. In India and South China, however, rat fleas transmit the deadly disease called plague. Avoid this threat by spraying your quarters with Aerosol or DDT and keeping rats out.

Food and Water

In warm climates foods spoil quickly. There is danger also of contamination of food and water by germs which cause typhoid, dysentery and cholera. You can prevent typhoid and cholera, to a large extent, by immunization injections. The dysenteries, however, cannot be prevented in this way. You must rely instead on sanitary measures and precautions. Know what foods are safe and how to protect yourself against those that may not be.

The safest food is served in Army messes. If canned rations are used they should be eaten soon after opening or stored in a cool place under fly-proof covers.

Food obtained from natives should be thoroughly cooked before eating. Thick-skinned fruits which can be peeled need not be cooked. Lettuce, radishes, celery, salad greens, melons, and strawberries are likely to carry disease germs. Never eat them raw. The natives commonly soak melons in water, often polluted, to increase their weight. Never use milk products such as butter, cheese, and ice cream, which are sold by the natives.

In desert and tropical regions, water also is important in transmitting intestinal infections. Consider all surface water unsafe, whether in streams, wells, fountains, ditches, or cisterns. Don't wash in it, don't brush your teeth with it, and above all don't drink it! Don't even put ice in your drinks unless the ice has been prepared by the Service. Native ice may harbor germs of dysentery or typhoid.

Water of questionable purity should always be sterilized before you use it. You can sterilize water in any one of three easy ways:

1. Boil it for at least 5 minutes.
2. Use Water Purification Tablets (Halazone). Add one tablet to the pint, shake, and wait a half-hour before drinking.
3. Add three drops of iodine to the quart, shake, and wait a half-hour before drinking.

Care of the Skin.

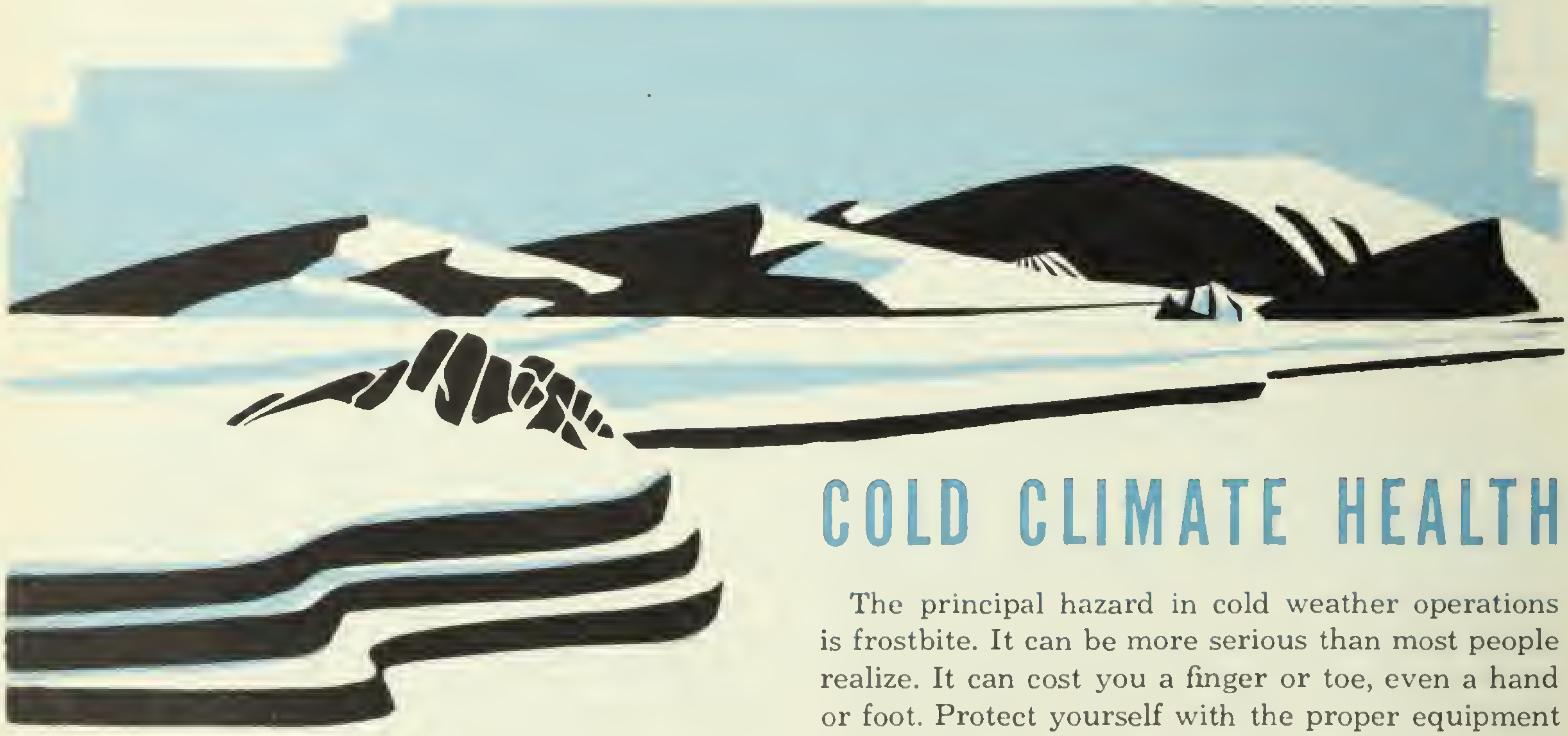
In hot climates, skin troubles are common. Treat even trivial cuts, scratches, and bites promptly (See PIF 8-14-1); or serious infection may result. Don't hesitate to see your Flight Surgeon. The following precautions will help keep you out of trouble.

Never walk about with bare feet in warm climates. Floors are likely to harbor the germ that causes athlete's foot. Consider all native areas infected. Small worms in the soil may burrow into the skin and cause infections such as hookworm or bilharziasis. Don't go swimming on beaches near native villages. The water may be contaminated with the flukes which cause schistosomiasis.

Bathe yourself and change your sox and underwear as often as possible. Keep the skin folds between the toes, in the armpits, and the groin clean and dry to prevent fungus infections like ringworm. Powder these parts liberally with GI foot powder.

Venereal Diseases.

In the tropics, venereal diseases are common, among prostitutes and most native women as well. In addition to syphilis and gonorrhea, large numbers of them are infected with chancroid, lymphogranuloma venereum, and granuloma inguinale. Don't give them a chance to give it to you. The treatment of these diseases is longer than their names.



COLD CLIMATE HEALTH

The principal hazard in cold weather operations is frostbite. It can be more serious than most people realize. It can cost you a finger or toe, even a hand or foot. Protect yourself with the proper equipment and by observing a few simple principles.

Clothing

All clothing should fit loosely. This applies particularly to your sox, boots, and gloves. Tight-fitting clothing interferes with the blood circulation and makes you more susceptible to frostbite. Individual garments should be light and porous. Wear several layers if possible. Two light garments afford better insulation than a single heavy one. Wear long woolen underwear on all flights over cold regions. Wear two or three pairs of loose-fitting woolen sox in sub-zero climates, but be sure that your boots fit loosely over them.

Leather shoes are dangerous in extreme cold. They not only afford poor protection, but may cause harm if they fit tightly over your sox. Don't wear ordinary GI shoes inside your winter flying boots. Use woolen sox and felt liners or electrically heated shoes instead.

If possible wear two pairs of gloves or mittens—a rayon or other light pair inside heavier ones (either A-9's, A-12's, or electric gloves). Mittens are better than gloves, for they allow your fingers to come in contact with each other and help keep them warm.

Keep your sox and underwear clean. After they have become soiled by body oils and secretions, they lose much of their insulation value.

Keep Your Clothing Dry

Wet clothing is almost worthless in protecting you from the cold. If any part of your clothing becomes moist, either by accident or through perspiration, take it off and dry it over a fire or change to dry clothing immediately. Wet feet and hands are particularly dangerous in cold climates for they fall easy prey to frostbite.

Exercise to keep warm but guard against overexertion in extreme cold. Overexertion makes you sweat and the perspiration may turn to ice inside your clothing. This is dangerous. If necessary to perform much physical work, open or remove some of your clothing in order to prevent perspiration. Don't put on a heavy suit until just before takeoff. Wipe your body dry; then dress slowly. Once dressed, exercise no more than necessary.

Electrically Heated Flying Suits

Electrically heated flying suits permit you to fly for long periods at extreme altitudes without getting cold. They have the advantage of eliminating bulkiness and permitting greater ease in manipulating the controls. There is one great disadvantage however, in relying on them while flying over cold regions. If your electric system fails, if you are forced down, or if you have to bail out, you are left without adequate protection against the cold. Always carry additional heavy clothing with you on such flights.

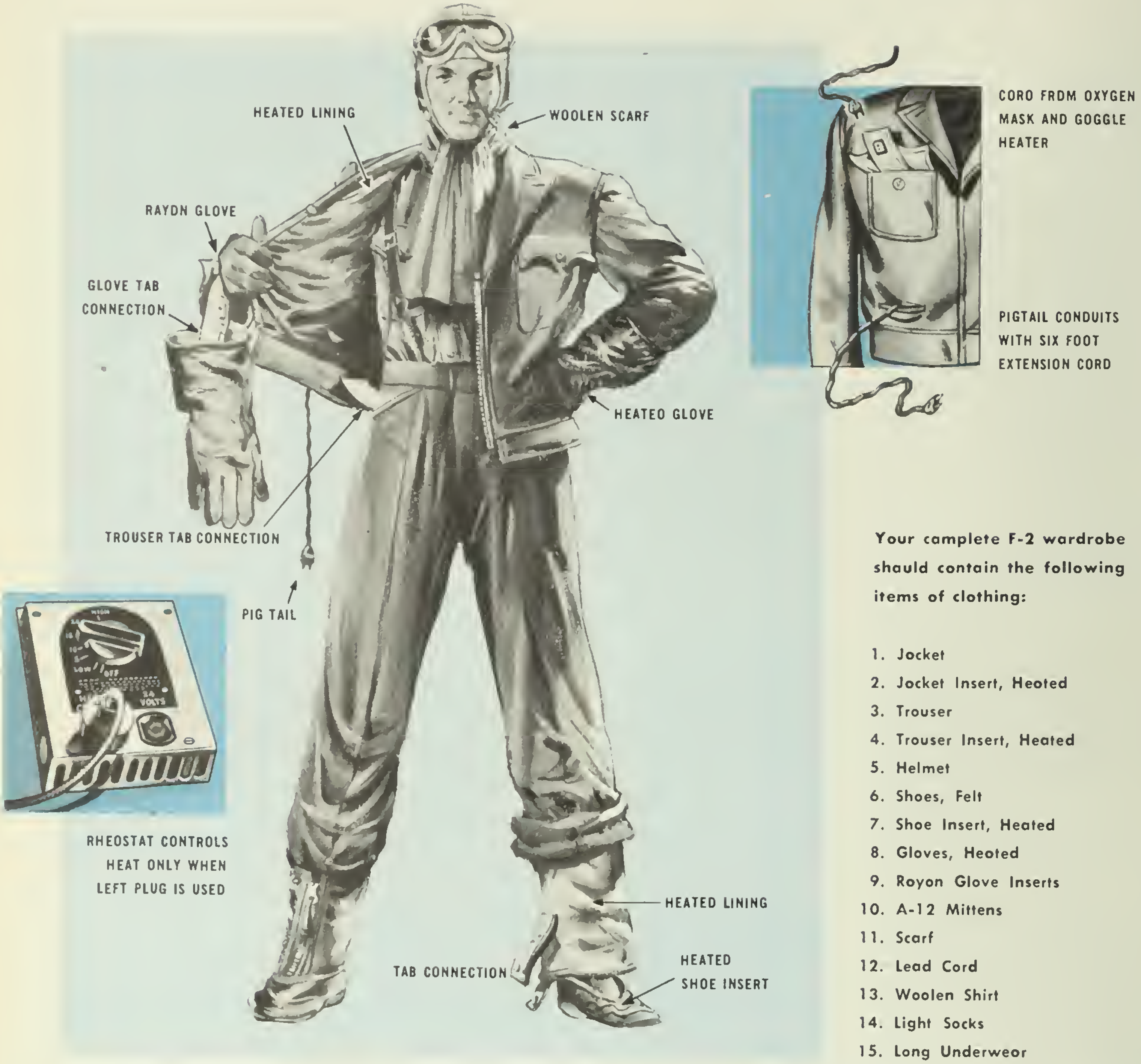
Know how to use your electrically heated suit, and treat it carefully. The electric heating elements are fragile. Hang your suit up to dry between flights, if possible, and have it tested by your Personal Equipment Officer. Two types are now in use, the F-2 and the F-3. They will protect you down to –40°F. If lower temperatures are encountered, add other flying clothing.

How to Wear the F-2 Suit

1. Wear your F-2 electrical suit over long woolen underwear. (If your suit is the F-1 type, wear additional clothing over it as well.) The F-2 suit affords adequate protection down to –40°F. If operating at lower temperatures, add other flying clothing.
2. Put on the shoes with inserts over lightweight woolen sox. Then connect the snap fastener tabs on the trouser leg to the corresponding snaps on the shoe insert. **Be sure that both pairs of snaps are properly connected.**
3. Connect the tab at the top of the trousers to the corresponding snap fasteners on the inside of the jacket at the right. Make certain both pairs of snaps are securely snapped together. Connect 6-foot lead cord to jacket pigtail.
4. Put on regulation flying helmet and auxiliary equipment. Protect your neck from the cold by wearing a wool or silk scarf.
5. Put on lightweight rayon gloves. Snap the tabs on the jacket sleeves to the corresponding snaps on the heated gloves. Then put on the electrically heated gloves.

How to Wear the F-3 Suit

1. Begin to dress by putting on long woolen underwear, woolen sox, GI trousers, and shirt.
2. Then add the F-3 electrically heated trousers. Adjust the shoulder straps to fit comfortably. Your F-3 heated jacket goes on next. Make sure both trousers and jacket fit properly.
3. Connect cord on right underside of jacket to receptacle at waistline of trousers. **Make certain both prongs of plug fit into receptacle.**
4. Now put on heated shoe inserts. Type F-2 is used for both F-2 and F-3 suits. **Connect both snap fasteners** on each leg of the heated trousers to snaps on shoe inserts.
5. Next come the A-9 alpaca-lined trousers. Reach inside right or left pocket and pull electric cord or



F-2 ELECTRICALLY HEATED FLYING SUIT

Your complete F-2 wardrobe should contain the following items of clothing:

1. Jacket
2. Jacket Insert, Heated
3. Trouser
4. Trouser Insert, Heated
5. Helmet
6. Shoes, Felt
7. Shoe Insert, Heated
8. Gloves, Heated
9. Rayon Glove Inserts
10. A-12 Mittens
11. Scarf
12. Lead Cord
13. Woolen Shirt
14. Light Socks
15. Long Underwear

pigtail through. Then put on the B-10 jacket.

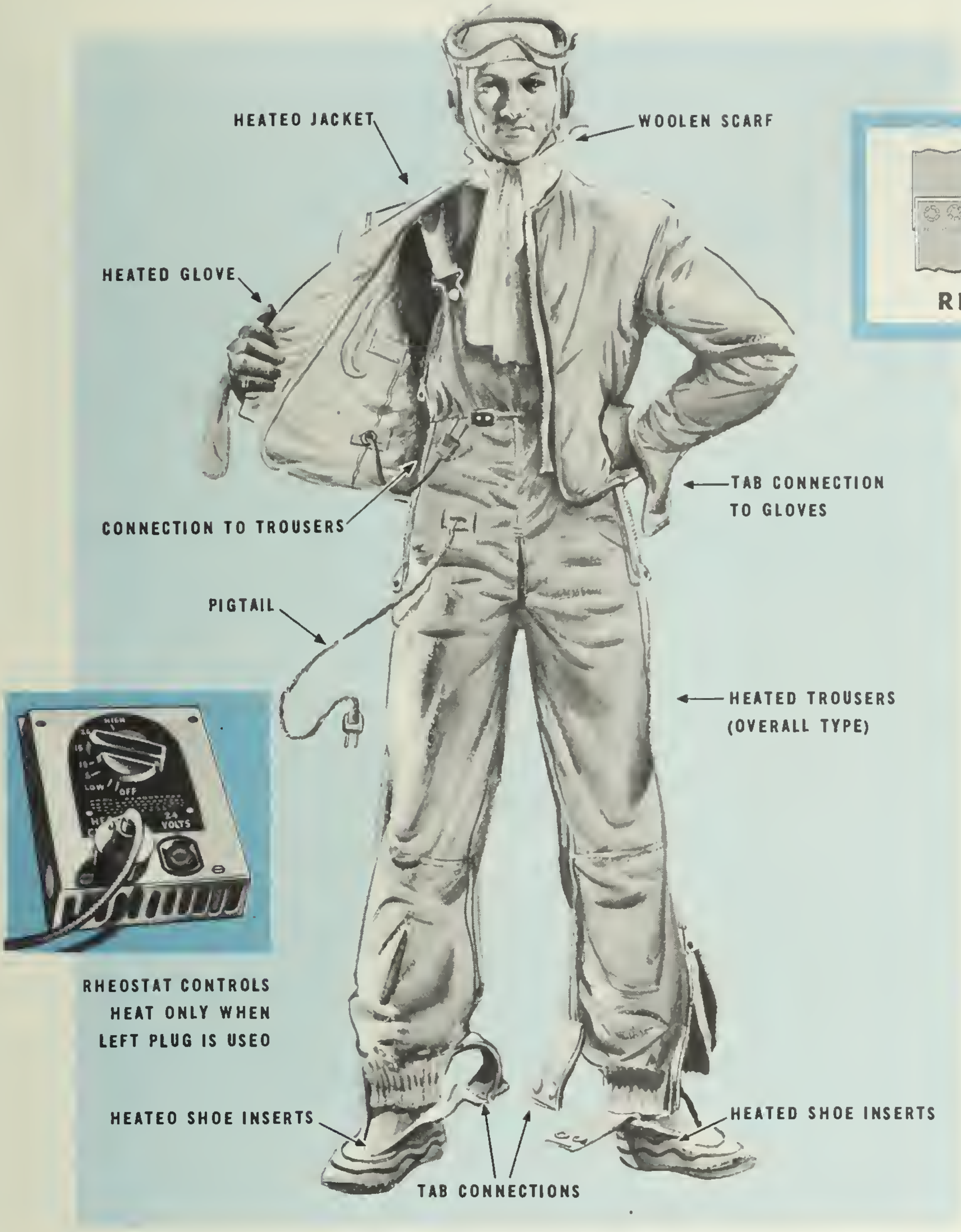
6. Now, the finishing touches: outer boots, helmet, and scarf. Connect 6-foot lead cord to pigtail.

7. Check all previous steps. Then add your gloves: first, the rayon or silk gloves, then snap tabs on sleeves of heated jacket to snaps inside gauntlets of electrically heated gloves. Now put on your heated gloves. Take along a pair of A-9 mittens, in case of emergency.

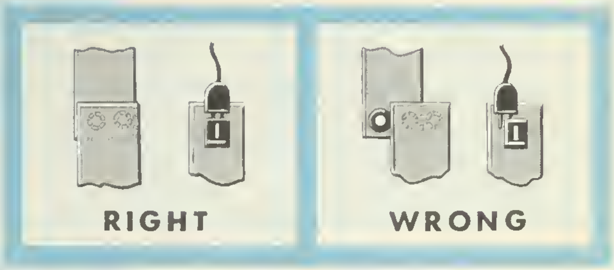
8. You can plug an oxygen mask heater or electrically heated goggles into the connecting block on the front of your trousers.

Connect your extension plug in the left receptacle of the built-in rheostat before takeoff and be sure that the suit is working properly. The plug can be locked into position by a simple clockwise twist. When in flight, keep the rheostat at the lowest comfortable heat. Don't ride hot, it will make you sweat.

Never rely on electrically heated suits alone when flying over cold regions. They are safe for use over temperate or tropical zones where cold is experienced only at high altitudes.



F-3 ELECTRICALLY HEATED FLYING SUIT



MAKE CONNECTIONS PROPERLY

Your complete F-3 wardrobe should contain the following items of clothing:

1. Jacket, Alpaca lined, Type B-10.
2. Jacket, Heated, Type F-3
3. Trousers, Alpaca lined, Type A-9
4. Trousers, Regulation GI
5. Trousers, Heated, Type F-3
6. Helmet
7. Shoes, outer felt or Type A-6
8. Gloves, Heated, Type F-2
9. Gloves, rayon or silk
10. Mittens, Type A-9
11. Scarf
12. Lead Cord
13. Shirt, Regulation GI
14. Socks, Regulation Wool
15. Long underwear

Check your suit after each flight. Look for excessive wear at all flexion points where electric wires might short out or break. If an ohmmeter is available, check the resistance of your suit at frequent intervals. The resistance in ohms is marked on the trousers, jacket, and each shoe and glove. If the ohmmeter shows the resistance to be more than 10% off, turn in the item for a new one.

Frostbite

Frostbite occurs most commonly in the fingers, toes, nose, ears, chin, and cheeks. It may set in gradually and painlessly and without your being aware of it. Numbness, stiffness, and a whitish discoloration of the affected part are among the first signs. Wrinkle your face frequently when exposed to cold air; if it feels numb, warm the affected part with your ungloved hand until sensation returns.

Crew members should watch each other's faces and be on the alert for areas of blanching. In this way serious trouble can be prevented. Frostbitten tissues may later become painful. Such tissues should

Warm hands by placing inside clothes under armpit

never be rubbed. Never apply snow or ice to a frostbitten part. If your hand becomes cold or numb, warm it by placing it inside your clothing or under your armpit. Frostbitten tissues should always be thawed gradually. When possible, thaw them at ordinary room temperature. They should never be placed near a heater or immersed in warm water or in kerosene. Any of these procedures may cause irreparable damage.

If frostbite occurs, cover the frostbitten area with a loose sterile bandage. Keep the patient comfortably warm with blankets or a sleeping bag and by giving him hot drinks; and give him 100 per cent oxygen to breathe (Auto-Mix "OFF" or "100% OXYGEN"). Report to your Flight Surgeon immediately after returning from your flight.

In extremely cold weather never touch cold metal with your bare hands, even for a moment. Your skin may freeze to it. If by accident this should happen, thaw your skin loose from the metal by warming the latter or by urinating upon it—don't pull your fingers loose.

Don't touch cold metal with bare hands

Snowblindness

Snowblindness is caused by exposure of your eyes, even for brief periods, to the glare which exists in snow-covered regions. The resultant damage to your eyes may cause intense pain and seriously interfere with your vision for several days—sometimes even longer. The hazard of snowblindness is particularly great on sunny days, but the glare which results from a bright overcast is almost as dangerous. Always protect your eyes by wearing colored goggles or sunglasses. In the Arctic, snowblindness may be brought on by merely lifting your goggles a half dozen times.

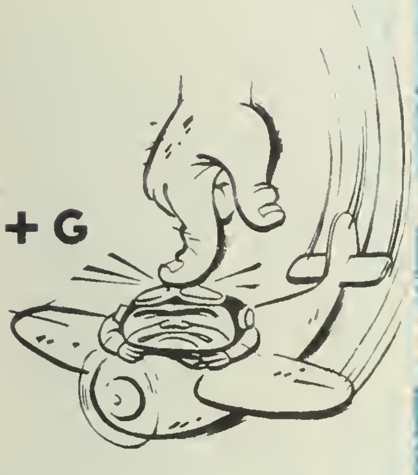
Wear colored goggles or sunglasses

Body Heat

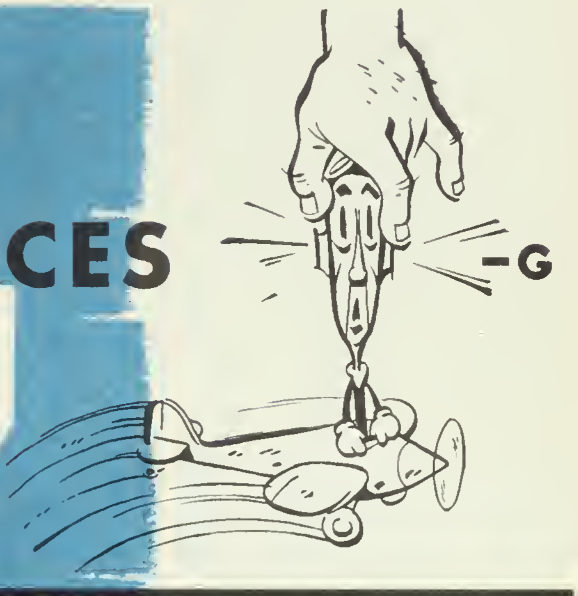
Eat an abundance of fatty foods while in cold regions. Fats are rich in calories, which help you maintain body heat. Take hot drinks such as coffee, tea, cocoa, or soup in thermos jugs along with you on all flights. These also add to your body warmth.

Never drink alcoholic beverages to keep warm. They give you a false sensation of warmth but may do great harm by actually robbing you of your body heat, since they cause flushing of the skin. This loss of heat, together with the false sense of security which alcohol produces, makes alcoholic beverages dangerous to anyone who is exposed to cold.

Don't eat snow! Melt it before drinking



G FORCES



G forces act on your body in flight:

With the normal pull of gravity.

When you change velocity.

When you change direction.

The force of gravity keeps you in your seat during straight and level flight and brings you down to earth if you bail out. Change of velocity pushes you against the back of your seat during takeoff (acceleration). It throws you forward during a crash landing (deceleration) if you don't wear your shoulder harness. It causes the shock you feel when your parachute opens after a bailout.

The forces which result from changes in direction, as in pull-outs, turns, and spirals, are of special importance to pilots, particularly fighter and dive bomber pilots. Unless you know how to overcome or compensate for them, these forces may have serious effects on your body.

The symbol G expresses the amount of force. The normal force which gravity exerts on your body at rest is 1G. When a force of 4G acts on you, your body weighs 4 times as much as it does at rest.

In straight and level flight your body can stand almost any speed if you are protected from the windstream. When you change direction during high speed maneuvers, however, centrifugal force imposes an additional load on you and your airplane. The greater your speed or the less the radius of turn, the greater the G force.

Positive G (+G)

When you pull out of a dive or make a spiral turn, your head points inward from the circular path of your airplane. Centrifugal force acts on your body, from head to seat. Force acting in this direction is called positive G (+G). It pushes you down against the seat and makes it difficult for you to raise yourself out of it.

Positive G forces the blood into the lower parts of your body and away from your head. With less blood your eyes and brain can't function properly. At first vision dims; this is called graying. Then you can't see at all; this is called blackout. Finally, if the G force is high enough or lasts long enough you lose consciousness. When the G force decreases, vision returns after one or two seconds if you have not lost

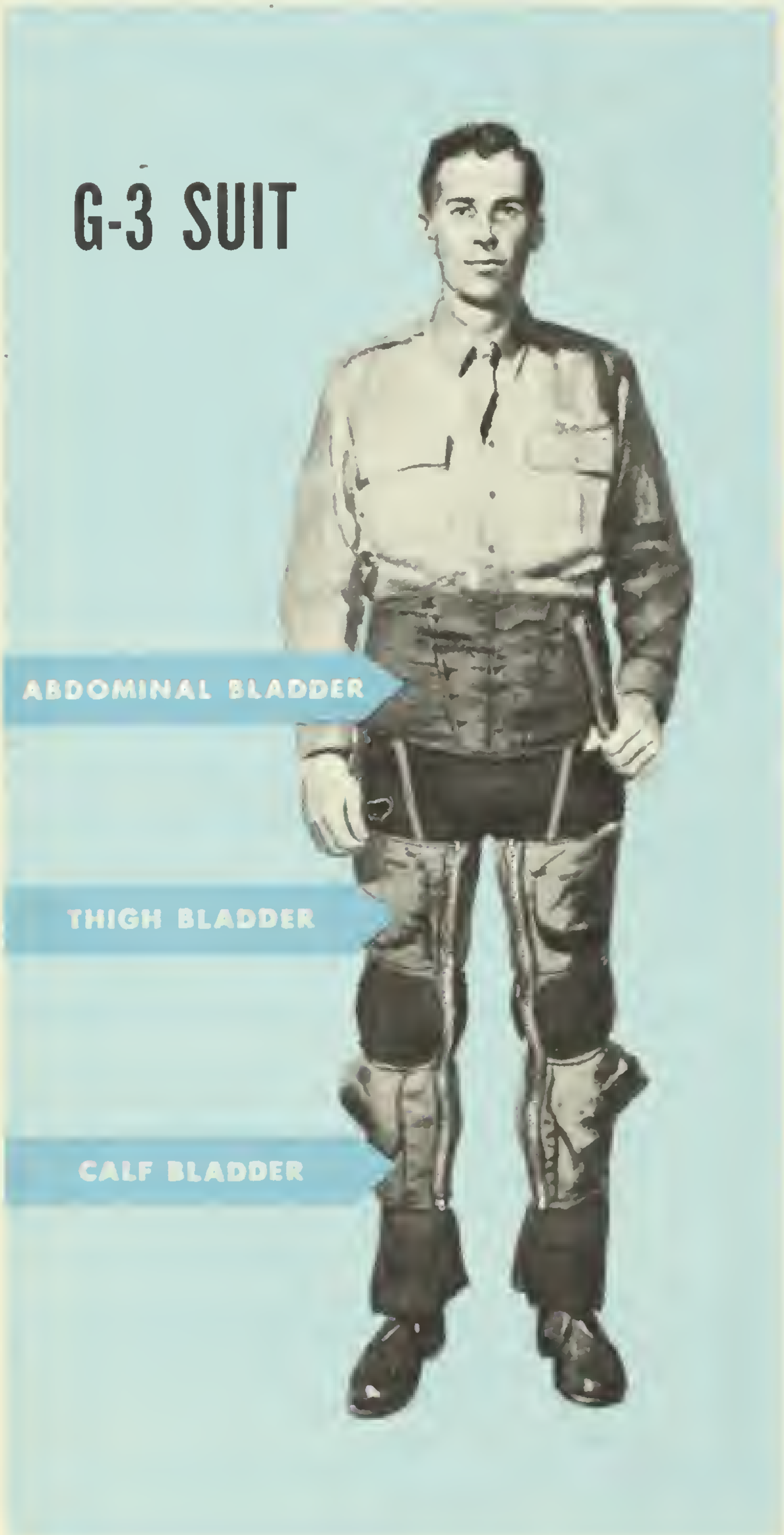
Positive G develops quickly in a spin. You can save time in bailing out if you have your parachute on. Wear it whenever possible. Don't wait for an emergency and depend on getting it on then. It may be too late. Even simple movements are hard to make against the force of positive G. It may pin you helpless to your seat or against the fuselage.

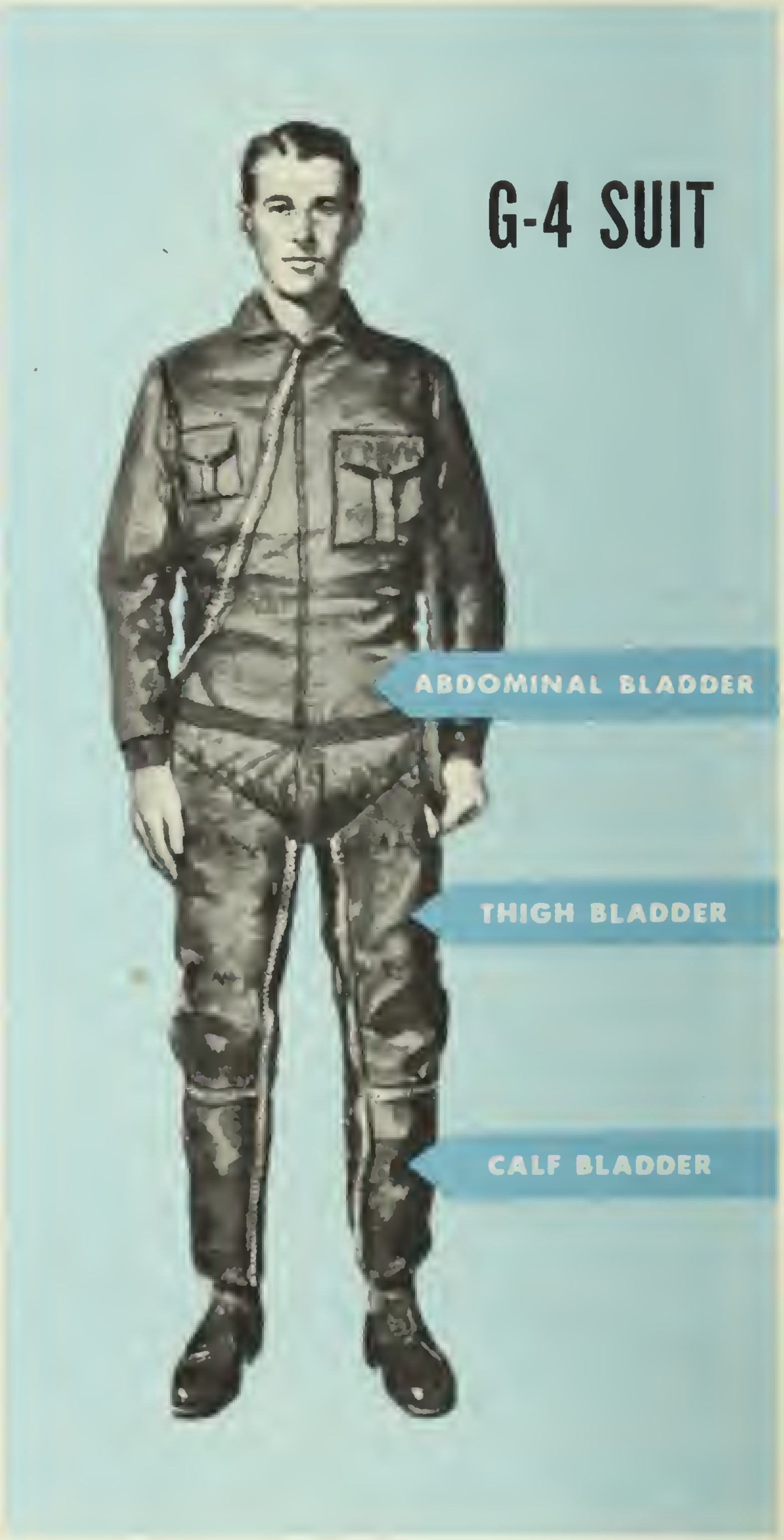
consciousness. But if you pass out, it may take a full minute to regain your senses completely.

People differ in their ability to resist G forces. The average man blacks out at 5G within 10 seconds. The longer the exposure, up to about 10 seconds, the more serious the symptoms. But after the first 10 seconds of maneuvers that increase G, you can usually stand a higher G force. If you ease off on the stick when you begin to gray out, you can take more G when your vision clears. Know your own reactions to G and don't exceed your limits.

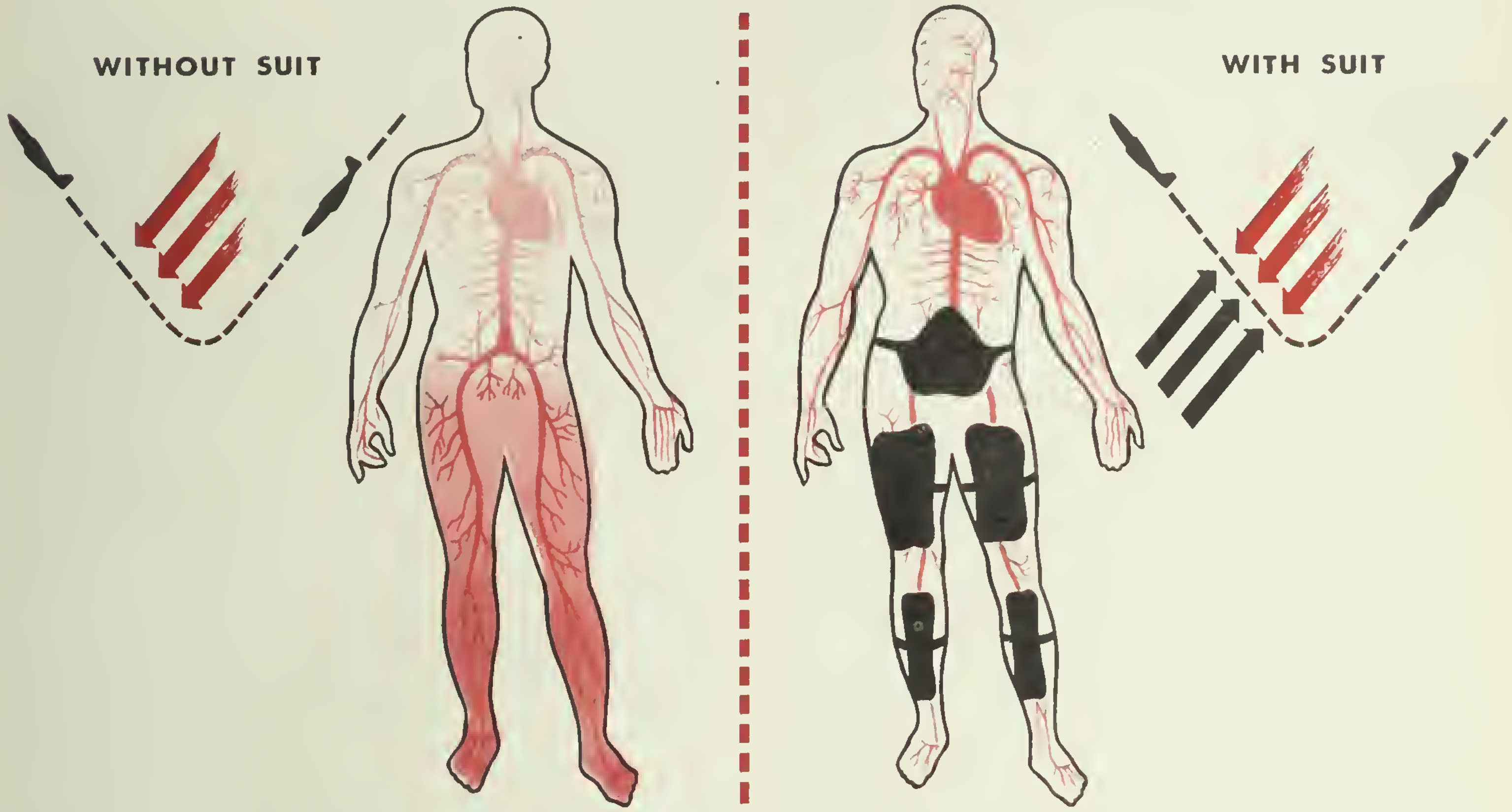
Anti-G Suits

Anti-G suits increase your resistance to positive G during flight. They consist largely of air bladders which fit over your calves, thighs, and abdomen. Centrifugal force causes each bladder to inflate automatically from a valve connected to the vacuum instrument pump of the airplane. The pressure in the bladders increases with the amount of G and so keeps the blood from pulling away from the head. The anti-G suit increases your body's resistance to





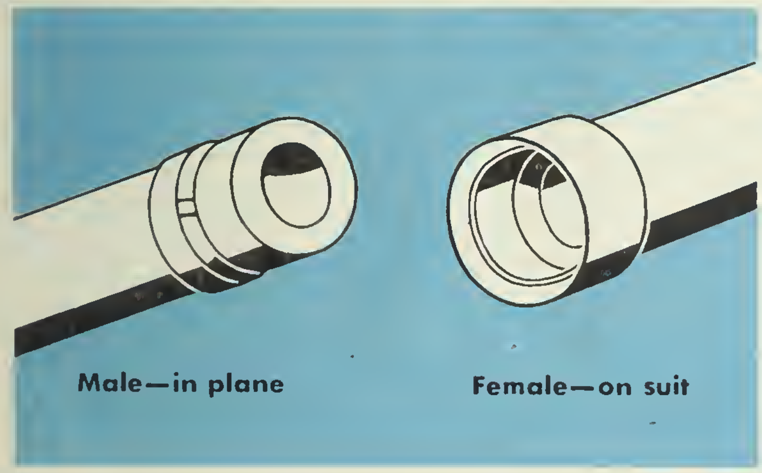
THE ANTI-G SUIT IS AUTOMATIC. It exerts no pressure on you in level flight, but the bladders inflate or deflate in 2 seconds when the G force rises above or falls below 2G. Just plug in the disconnect—the valve does the rest.



centrifugal force by 1 to 2G. Remember, however, that your airplane has G limits also. Know them and stay within them.

The fit of the anti-G suit is important. Check it with your Personal Equipment Officer. The suit is washable, but don't boil it.

The disconnect of the anti-G suit should come apart easily with a pull of 5 to 15 pounds. Try it before takeoff. If it is too tight, ream the outer lip of the female end of the disconnect with a knife, or ask your Personal Equipment Officer to crimp the spring in the male end of the disconnect. Keep the disconnect close to your body so that it will break or come away with you if you bail out.



Personal Resistance to G Forces

If you have no anti-G suit, you can increase your resistance to G forces by muscular straining:

1. Pull head and neck down between shoulders.
2. Tense all muscles and strain against safety belt.
3. Keep breathing. Yell "Hey" over and over.
4. Keep straining until G is passed.

Negative G (–G)

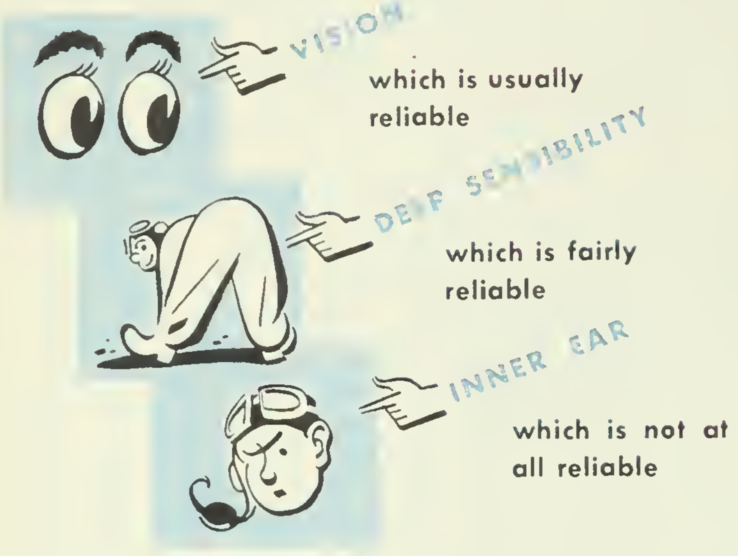
During inverted flight, outside turns, and push-downs, centrifugal forces act on your body, from seat to head. Force acting in this direction is called negative G (–G). It drives the blood into your head and increases the pressure in the blood vessels there.

Neither you nor the airplane can stand as much negative G as positive G. At −2 or −3G your head feels full and throbs. You have a gritty sensation in your eyes and you see red. This is called red-out. Recovery from the effects of negative G may take several minutes. Prolonged negative G may cause hemorrhage into the eyes and brain. Avoid it.

REFERENCE: Technical Order 13-1-23

SENSE OF POSITION IN FLIGHT

Your sense of position, both on the ground and in the air, is governed by:



VISION which is usually reliable

DEEP SENSIBILITY which is fairly reliable

INNER EAR which is not at all reliable

1. Vision is the all-important sense in contact flying. Vision furnishes your natural horizon. It is loss of vision which makes the transition from contact to instrument flight difficult, unless you learn to trust your gyro-horizon and other flight instruments with as much confidence as you do the natural horizon. In instrument flight, rely only on what you see in the cockpit.

2. The combination of sensations of pressure and tension on the skin, muscles, tendons and internal organs is known as deep sensibility.

When your feet are on the ground, sensations from your soles and the muscles of your legs tell you what position your feet are in. This deep sensibility is an important factor in helping you maintain your bodily balance.

In flight you get the effect of deep sensibility in the seat of your pants, since gravity and centrifugal force exert their action there. Changes in the position of your plane make you feel heavier or lighter, or as if you were being forced sideways in your seat.

3. When you can't check your position by visual reference, you rely mainly on your inner ear. The inner ear has two parts. The semicircular canals, which are placed in three different planes, are responsible for the sensation of rotation or turning, pitching and rolling. The static organ tells you the position of your head in relation to the ground.

INSTRUMENT FLIGHT

The sensations provided by deep sensibility and the inner ear lead to confusion when you are flying on instruments. Never trust your feel or sense of position when you are flying on instruments or at night; if you do, you'll get into trouble since the sensations from the seat of your pants and your inner ear do not indicate the true position of your airplane.

You often get false impressions when on instruments even during straight and level flights and especially in turns.

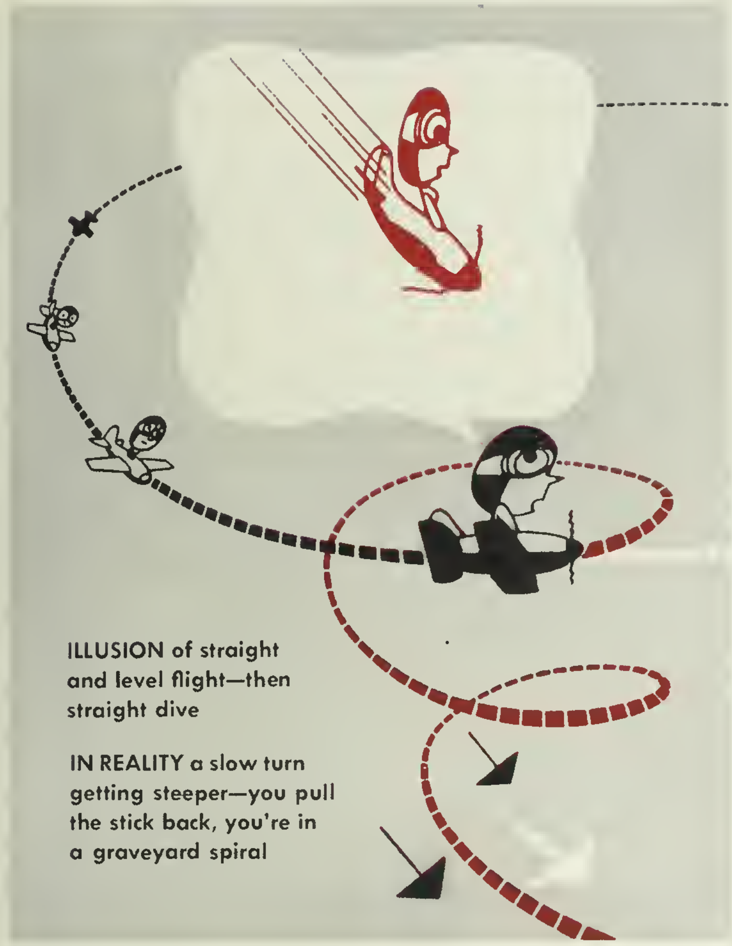
Sensory Illusions in Straight Flight

1. If your airplane tilts or tips suddenly in rough air and recovers slowly, you may not know when recovery is complete. Your inner ear retains the impression that your aircraft is still tipped or tilted. This impression may be so strong that you may lean to one side in an attempt to remain upright. **The leans** is one of the most common sensations experienced during instrument flight.

2. If you don't check your instrument readings every few minutes, your airplane may turn from the desired heading so slowly that you won't notice it. Then when you check with your instruments and correct your heading and position, you will feel that you are continuing your turn in the opposite direction.

3. The greatest single danger to an inexperienced pilot flying at night or on instruments is the **Graveyard Spiral.** This is a diving spiral which gets progressively tighter and steeper, and which is accompanied by a rapid loss of altitude.

Such a spiral results directly from relying too much on your sensations and too little on the instruments which indicate bank and turn. The spiral starts when the airplane gradually enters a turn without your realizing it. In such an involuntary turn the angle of bank and the rate of turn both increase so slowly that you have no sensation to warn you that the position of your airplane has changed. You retain the positive impression that you are still flying straight and level. Your first indication that anything is wrong is a change of noise, an increase in airspeed or a loss of altitude.



ILLUSION of straight and level flight—then straight dive

IN REALITY a slow turn getting steeper—you pull the stick back, you're in a graveyard spiral

Under these circumstances, unless you look at and believe the instruments which indicate turn and bank, you may merely pull back on the stick, under the impression that by so doing you are recovering from a straight dive. If you do, this impression of being in a straight dive increases, since pulling back on the stick gives you the same feeling you have in a normal straight pullout from a dive.

Once you start to pull back on the stick, the turn gets tighter, the nose drops lower, and there is a great increase in airspeed and the rate of descent. After a few seconds the airplane may have more than doubled its original speed, and the rate of descent may have increased to several thousand feet per minute.

You can recover easily and quickly from such a spiral. **Remember: when anything seems to be going wrong, when the airplane is starting to lose altitude and gain speed, first look at the instruments which indicate bank and turn.** In all probability the airplane is banked and is turning, although your sensations make you feel it is in straight and level flight. Don't act according to your sensations. **Check and cross-check your instruments.**

4. The feel on the seat of your pants (deep sensibility) may make you think you are climbing when your airplane enters an updraft, or that you are diving when it enters a downdraft. You feel heavier in an updraft and lighter in a downdraft.

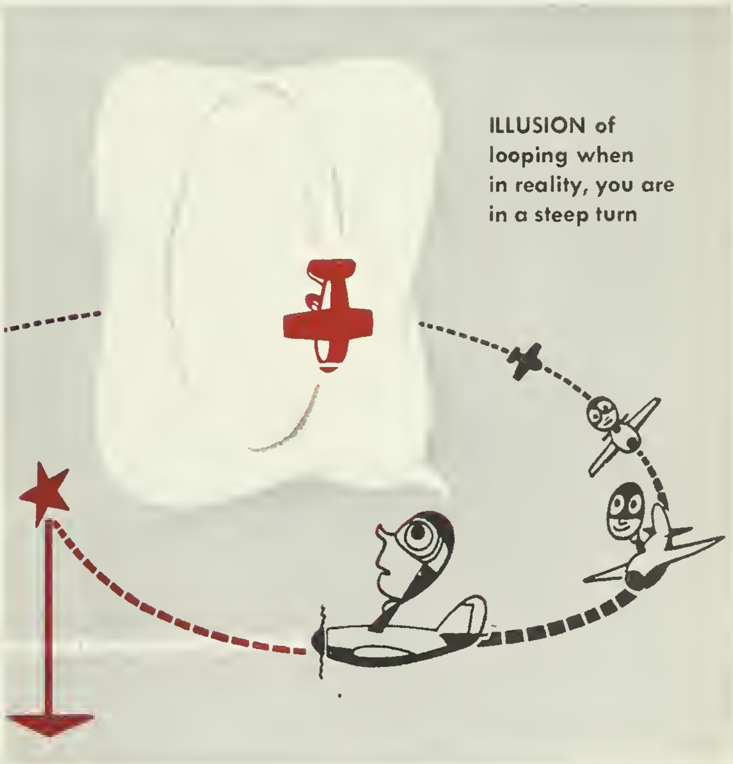
Sensory Illusions in Turns or Spins

1. The standard rate turn is a slow turn. In it you experience much the same sensations you do in straight flight.

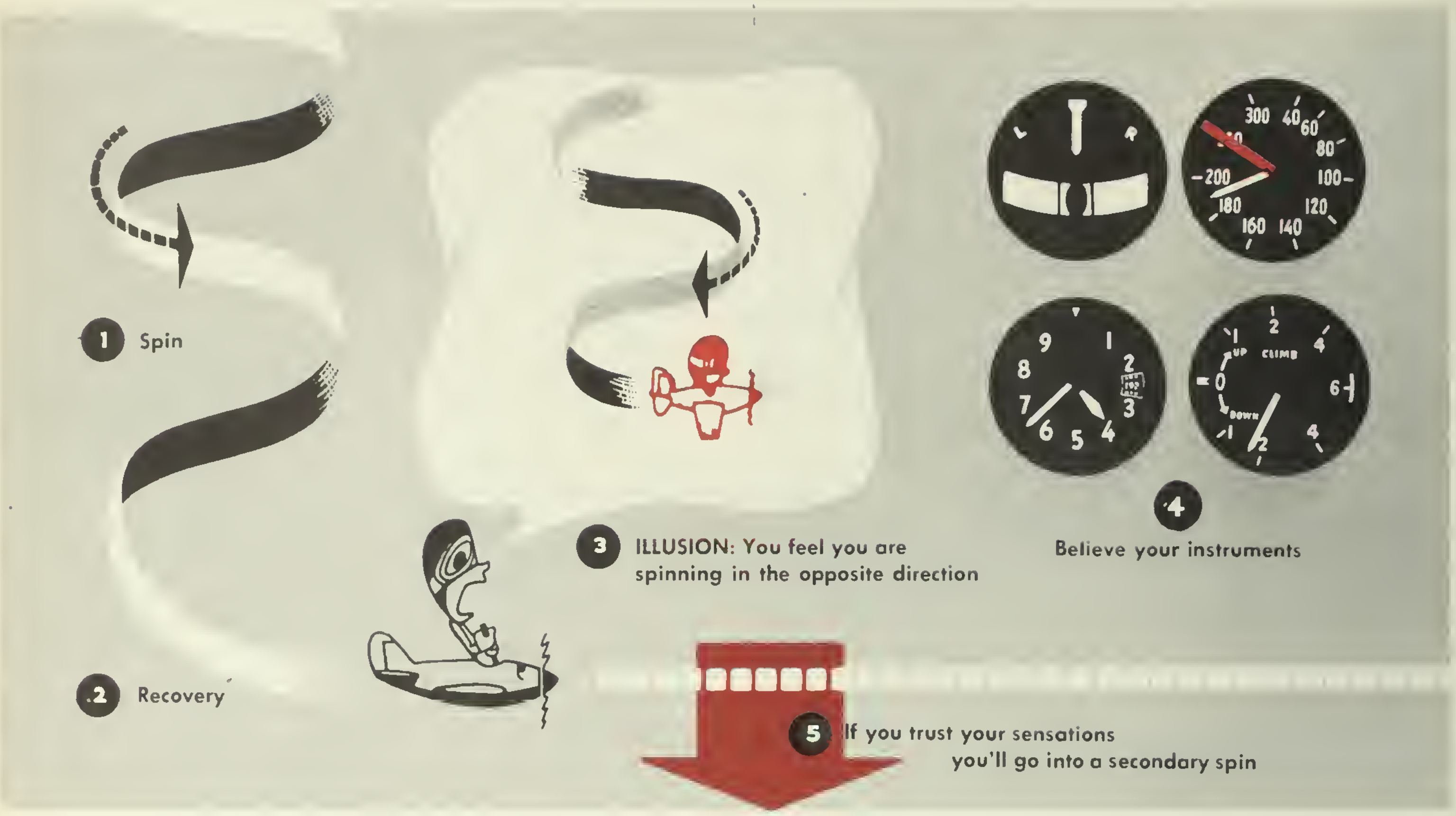
2. While performing steep turns, especially at high speed, your deep sensibility and the static organ of your middle ear may give you the sensation that you are in a loop rather than in a banked turn. When you come out of a steep turn your impulse may be to climb, because you begin to feel light. The force that has been pulling you hard against your seat lets up, so you think you are diving. If you trust your senses, you will stall the airplane.

3. If you hold your head steady in a turn, you have little sensation of turning. If, however, you move your head to look down or to the side in the cockpit, you will experience the sensation of doing a rapid roll, or of snapping around in the turn. You get this feeling because the new position of your head places another semicircular canal in the plane of rotation of the airplane.

4. During a spin you are subjected to high rotational speeds. If the spin is continued for more than an extremely short time, you will have, upon recovery, a marked sensation of falling off into a turn



ILLUSION of looping when in reality, you are in a steep turn


1 Spin
2 Recovery
3 ILLUSION: You feel you are spinning in the opposite direction
4 Believe your instruments
5 If you trust your sensations you'll go into a secondary spin
UP
CLIMB
DOWN

in the opposite direction. In attempting to correct for this sensation, you may fall into a secondary spin. **Check spin recovery by your instruments, and trust them.**

NIGHT FLYING

Many of the accidents in night flying result from the fact that pilots rely too much on vision, rather than on their instruments.

At night the inexperienced pilot may look around continually to find some light on the ground by which he can orient himself. Unless he is flying near a large city where there are enough lights to make a good pattern, this habit is extremely hazardous.

Any experienced pilot can tell how he has mistaken a star for a light beneath him and how he thought lights were moving past him, when actually he was turning about the lights. A pilot can easily get so confused that he doesn't know which way is up, or whether the airplane is turning, diving, rolling, or climbing.

Most confusing and dangerous of all is the situation in which the pilot attempts to look backward to see lights behind him, such as after a takeoff into unlighted territory.

You may become confused easily in night flying because your eyes deceive you. You have no definite horizon to use as a plane of orientation; you have only isolated points of light. Your senses may mislead you if you depend solely on these lights for orientation, and you may become greatly confused in handling your airplane.

The one solution for this is to watch the instrument panel, with only occasional glances at the lights. If you get the habit of using your instruments as a major reference and of using lights only as a secondary reference, you will not get into trouble.

AIRSICKNESS

Airsickness is one form of motion sickness, like sea sickness and train sickness.

Contributing factors are: rough air, fatigue, poor ventilation, prolonged cold or heat, vibration, emotional tension, and poor physical condition.

The following aids in preventing or minimizing airsickness have been suggested by the Air Surgeon. Pass them on to your crew members:

1. Keep the horizon in full view except when tactical consideration, such as searching the sky for enemy fighters, dictates otherwise.
2. Sit as near as possible to the center of gravity of the airplane, where least motion will be felt.
3. Concentrate thoroughly on your mission to its termination.

Reference: Technical Order 30-100A-1, Section 2.

THE FLIGHT SURGEON AND THE PILOT

The Flight Surgeon's chief responsibility is to keep you at peak physical and mental efficiency for flying. Consult him when you feel tired, worried, run down, or if things seem to be going wrong. He is your friend, understands your problems, and can usually help you straighten matters out.

He can also tell you about special health and sanitation problems and give you valuable tips for keeping fit in different parts of the world. Ask his advice on malaria control, atabrine, food and water, and salt tablets in hot regions. Listen to his ideas about prevention of frostbite (See PIF 4-7). Ask him about diet and the best foods to eat and how they affect your physical fitness. In fact, take any personal problems you have to the Flight Surgeon and talk them over with him. You are sure to receive helpful, sympathetic advice.

Physical Examination For Flying

Your Flight Surgeon is responsible in large part for your flying status. He helps restore you to flying status after sickness or injury.

You are required to have a new physical examination for flying (64 examination):

Each year, within the first 2 calendar months.

After absence or suspension from flying status because of serious illness or injury.

After absence from or suspension from flying status for more than 6 months for any other reason.

For reinstatement after invalidation of an aeronautical rating.

If you are suspended from flying status as a result of physical examination, you must pass another 64 examination before you can be restored to flying status, or you must get a waiver for the physical defect. Your Flight Surgeon can tell you if and how you can correct minor defects and advise you when to take another examination.

Medical Records

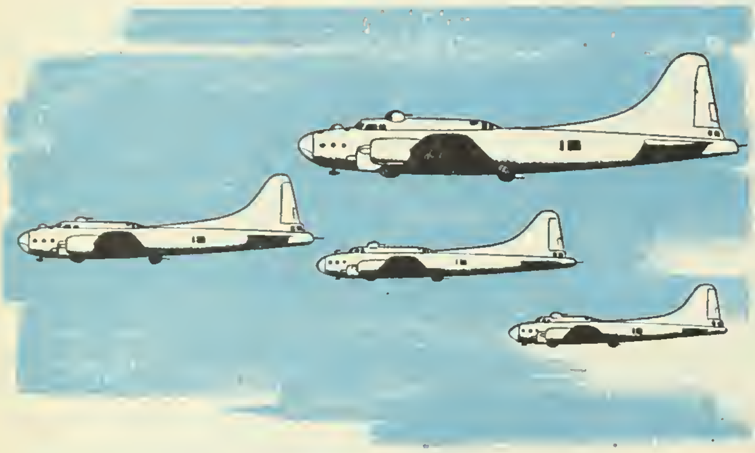
You are required to carry with you and take care of your Air Crew Member Physical Record Card (AAF Form 206). This card provides information for flight surgeons and operations officers concerning your fitness for flying. See that it is kept up-to-date. Have your Flight Surgeon record on it each examination he gives you and any illness or injury you

have. You are also required to carry with you your immunization register (old MD Form 81 or new AGO Form 8-117).

Your Flight Surgeon keeps a file of your physical examinations (64 file). If you are ordered to make a permanent change of station, present a copy of your orders to him so that he can forward your 64 file. Upon your arrival at the new station, report to the Flight Surgeon there and show him your Physical Record Card.

Every person on flying status is required to have a dental identification record (old MD Form 79; new AGO Form 8-116), which the Dental Officer keeps on file. When you change station, your Flight Surgeon forwards it with your 64 file.

Benzedrine



Benzedrine pills are a powerful, stimulating drug which can postpone sleep temporarily. They are often helpful in keeping you alert on long tactical missions. Decisions regarding the use of benzedrine rest with your Commanding Officer and Flight Surgeon. They must decide what situations require it.

People react differently to benzedrine. Before using it on a mission, have your own reaction to it tested on the ground and know what dose you need. **Don't wait until the day of the mission before trying out the drug.** It takes several hours for the effect to wear off. Ask your Flight Surgeon to test your reactions to benzedrine.

Benzedrine cannot substitute for sleep. It only helps keep you alert for a few extra hours. You must make up your lost sleep after it wears off. Wait until you are really tired before taking it. That is when it helps you most. Then be sure to follow your Flight Surgeon's instructions. Never take benzedrine on your own. **Too much makes you nervous and jittery and ruins your efficiency.**

Benzedrine is also used in inhalers, to help clear the nose when you have a cold. You can use an inhaler to help you clear your ears when descending from altitude. Don't use it too often, however, for you absorb the drug from the inhaler as well as in pill form.

Sulfa Drugs

The sulfa drugs (sulfonamides) are used to prevent and treat infections. You can take them by mouth as pills, or apply them externally in powder or ointment form. Sometimes, especially in large doses, these drugs produce dangerous reactions.

For this reason, no rated pilot or aircrew member is permitted to fly while taking sulfa drugs for the treatment of any disease. After you have stopped treatment, your Flight Surgeon must examine you before you may fly again, to make sure you are free of symptoms.

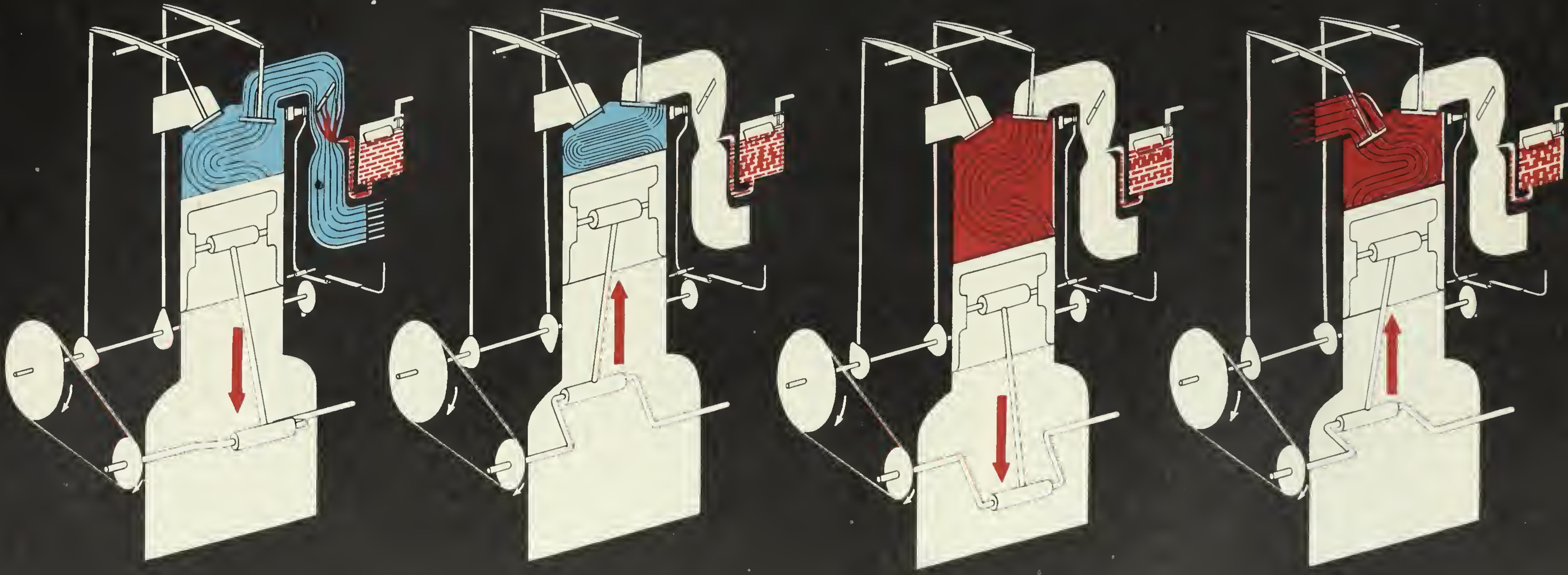
This restriction applies only while you are taking the drug by mouth in doses greater than one gram a day. Flying is permitted if you take the drug in smaller amounts for the prevention of disease, or if you use it externally.

Sulfa drugs can be dangerous. Never take them without the advice of a Medical Officer, except in emergency.

The instructions and provisions of the regulation governing flying status in relation to sulfa drugs (AAF Reg. 25-13) do not apply to passengers or patients being transported or evacuated by air. Neither do they apply to the emergency use of sulfa drugs in first-aid kits.

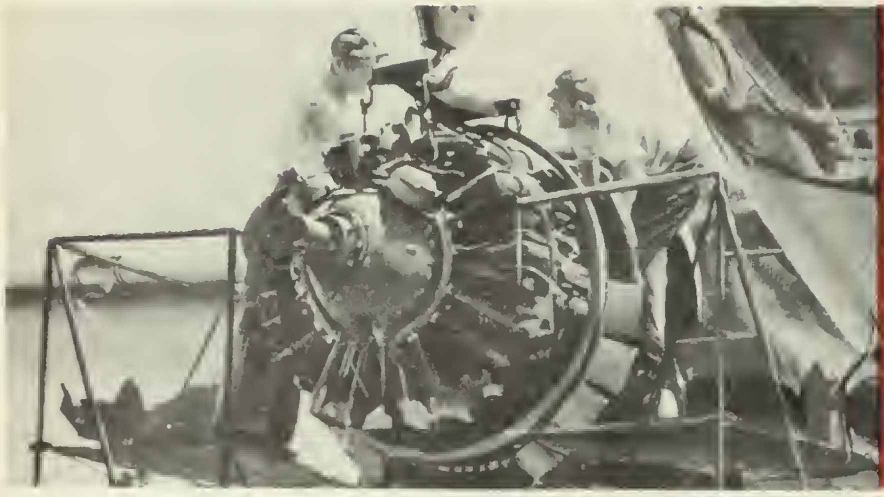
REFERENCES: AR 40-110, AAF Regs. 15-206, 25-13, 35-16

THE FOUR-STROKE CYCLE



INTAKE STROKE COMPRESSION STROKE POWER STROKE EXHAUST STROKE

SECTION 5 POWER PLANT



NOTICE!

This section, Power Plant, is both general and non-technical. It does not replace—in even a small way—the information in the T. O. and the Pilot Training Manual for your airplane. These publications are your bibles. Consult them for all specific operating procedures.

POWER EVALUATION

The frequency of aircraft accidents resulting from a glaring misuse of power indicates that many pilots do not fully understand use of the power plant. Although the following pages do not discuss aircraft engines or engine principles in detail, they may help you appreciate more fully the factors which influence power.

POWER OUTPUT

An internal combustion engine derives its power from the combustion of a fuel/air mixture inside a closed cylinder. The primary purpose of an aircraft combustion engine is to convert the latent heat of fuel into thrust.

Engine performance is described in terms of horsepower output.

The total horsepower developed in the cylinders, or **indicated horsepower,** is the result of the combustion of fuel mixture supplied to the cylinders.

Not all of the power developed within the cylinders of an engine reaches the propeller shaft. Part of the total horsepower is absorbed by the friction of moving parts, such as the rubbing of the pistons on the cylinder walls, and other mechanical friction which occurs during operation of the engine. The portion of total power thus absorbed is called **friction horsepower.**

Still another part is absorbed by engine-driven superchargers and engine-driven accessories, such as generators and hydraulic pumps.

The indicated horsepower less the friction horsepower and the other power absorbed is the power delivered to the propeller shaft, or the **brake horsepower.** Again, not all of this power is converted into useful work. The propeller is not 100% efficient. A portion is again lost here; but most of brake horsepower is converted into thrust and becomes **thrust horsepower.** The difference between brake horsepower delivered at the propeller shaft and thrust horsepower is a measure of propeller efficiency.

Engine Ratings

The AAF has established several ratings for an aircraft engine. These ratings divide engine power into different categories. They are:

Takeoff Rating: The maximum power permissible for normal takeoff.

Normal Rating: The power which the engine can deliver continuously without undue stress. This is the normal rated power of the engine.

Maximum Cruise Rating: The maximum power which, **with lean mixture,** the engine can deliver continuously without undue stress.

Military Rating: The maximum power available to the pilot in flight just below safety limits of the engine. This is usually equal to the Takeoff Rating and there is a definite time limit on its use.

War Emergency Rating: The highest power it is possible to obtain from an engine at the limit of its structural safety. It applies only to combat airplane engines and is used only for brief periods and under rigid stipulations prescribed in the pertinent T.O.

Brake Mean Effective Pressure

For practical purposes Brake Mean Effective Pressure (BMEP) is a measure of the average pressure, in pounds per square inch, within the cylinder during the power stroke of the piston.

BMEP is a factor used in establishing the operating limits of the engine.

When you exceed operating limits of the engine (as expressed in manifold pressure and rpm), you are likely to exceed the maximum allowable BMEP. This may result in engine damage and/or failure.

Horsepower is calculated from BMEP, rpm, and the cubic inch displacement of the engine.

Power Settings and Horsepower

The Flight Operation Instructions charts in the T.O. for your airplane prescribe a number of power settings for various flight conditions.

The five columns of power settings in the charts represent five different cruising conditions, ranging from maximum speed to maximum range. Power settings in Column I are for emergency high speed cruising only, and when you use them you are using the engine's normal rated power. Columns II, III, IV, and V give progressively lower power settings with increases in range at sacrifice of speed for any given altitude. **Remember, when the mission gives you a choice, operation with lower power settings conserves your engine.**

Here is an example of how much power an R1830-43 engine, with normal rating of 1100 horsepower, delivers at a given power setting (1830 refers to cubic inch displacement of engine):

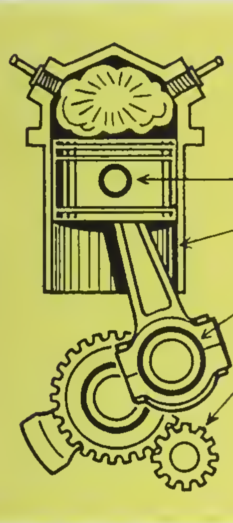
For instance, Column III of a chart specifies a setting of 33″ Hg and 2200 rpm at 20,000 feet. The engine is delivering approximately 790 brake horsepower, or 72% of normal rated power.

You can figure horsepower output and BMEP by using a power curve and a BMEP chart. The example given here is illustrated in the charts on the following pages:

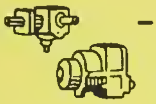
Horsepower developed within the cylinders is . . . . . **INDICATED HORSEPOWER**

minus

But not ALL of this power is available for "outside work"—



Some of it is used to overcome friction within the engine



—and some of it is required to drive such things as fuel pumps, oil pumps, and magnetos

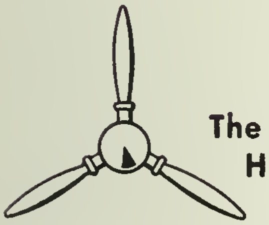
—and some of it is used to run the supercharger.

. . . . . **POWER THUS ABSORBED**

equals

Power delivered to the crankshaft is . . . . . **BRAKE HORSEPOWER**

minus



The propeller converts Brake Horsepower into Thrust Horsepower. But the propeller is not 100% efficient, so . . . . . **POWER ABSORBED THROUGH PROPELLER**

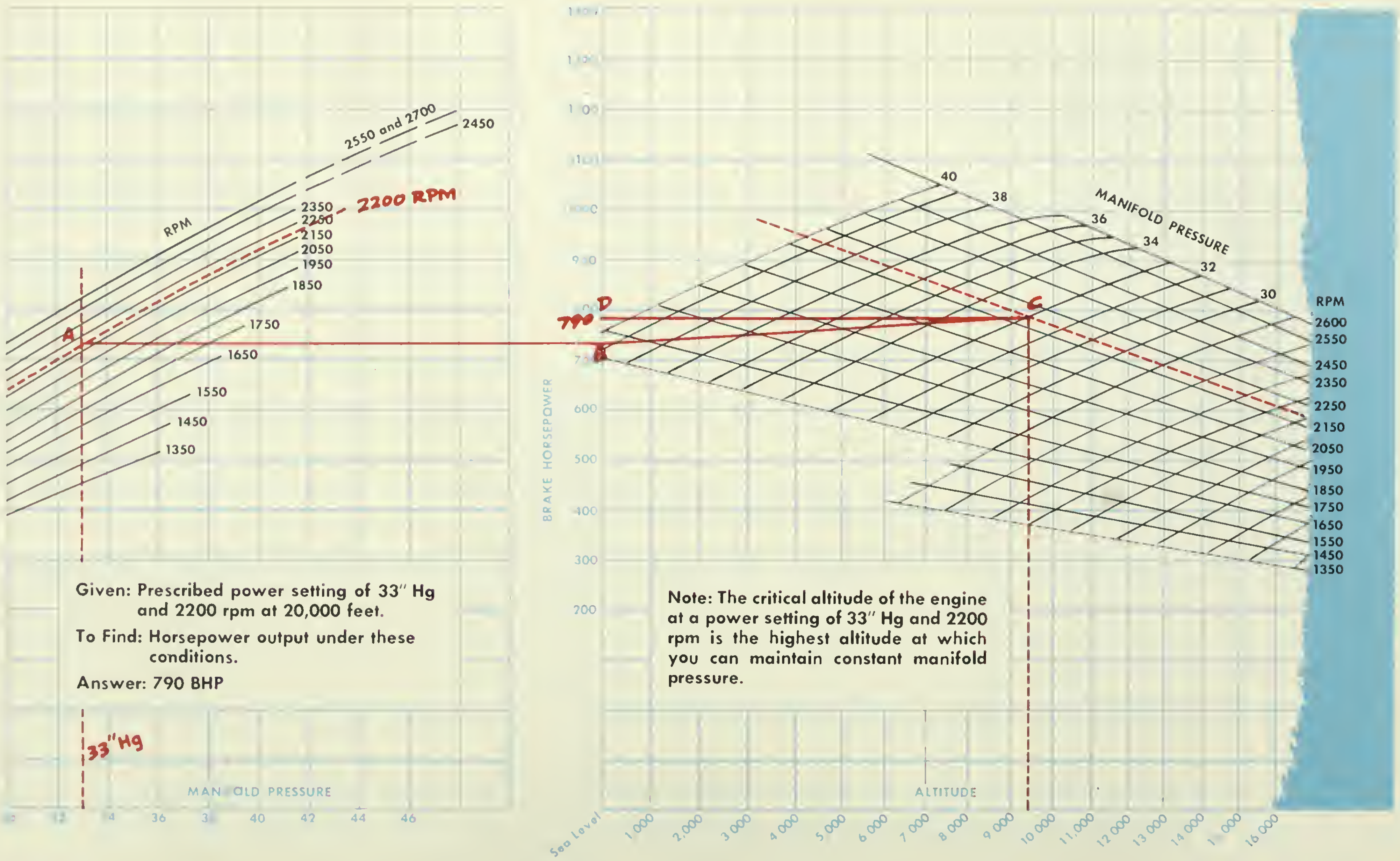
equals

THRUST HORSEPOWER

THIS IS POWER OUTPUT

Left-hand chart is used to calculate approximate horsepower at sea level.

Right-hand chart is used to calculate approximate horsepower output at critical altitude of engine (see note).



Given: Prescribed power setting of 33" Hg and 2200 rpm at 20,000 feet.

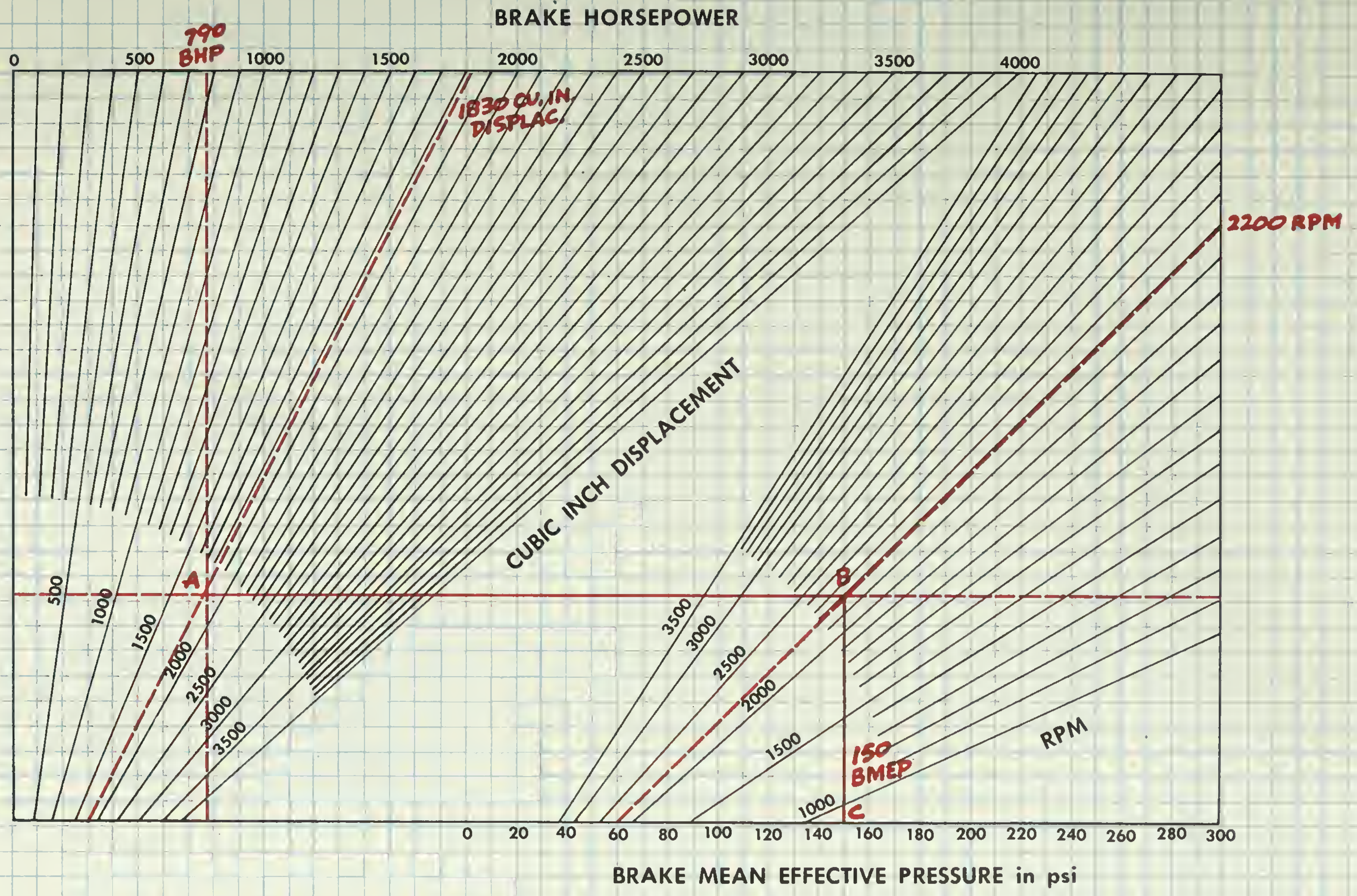
To Find: Horsepower output under these conditions.

Answer: 790 BHP

Note: The critical altitude of the engine at a power setting of 33" Hg and 2200 rpm is the highest altitude at which you can maintain constant manifold pressure.

1. Given manifold pressure line intersects given rpm line at A.
2. A horizontal line from A to B gives you the Brake Horsepower at sea level.
3. C, on the right-hand chart, is again the intersection of manifold pressure and rpm lines, and indicates the critical altitude of the engine, 9500 feet with 33" Hg and 2200 rpm (see note).
4. A line drawn horizontally from C to D gives horsepower output at critical altitude. The slanting line from B to C shows slight gradual increase in horsepower with altitude.

For altitudes above 9500 feet horsepower output will be held approximately constant by increased supercharging; so, in the example here, horsepower at 20,000 feet will approximately equal that at 9500 feet.



Given: **790 Brake Horsepower**
1830 Cubic Inch Displacement
2200 rpm

To Find: BMEP
Answer: BMEP = 150 psi

1. A is intersection of given Brake Horsepower and given Cubic Inch Displacement lines.
2. Horizontal line is drawn from A to B (given rpm line).
3. Vertical line is dropped from B to C, which is BMEP line and gives answer.

OPERATING EFFICIENCY

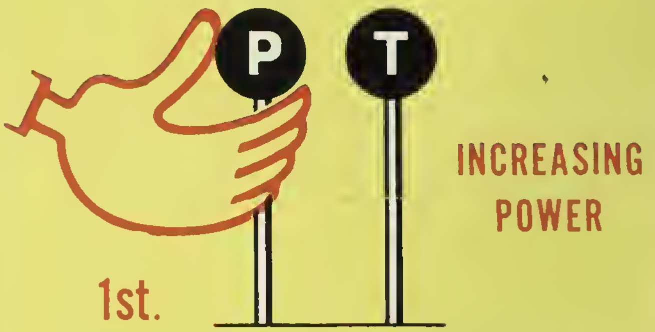
Manifold Pressure and RPM

It is most important that you have a thorough understanding of manifold pressure and rpm and the relation between them. Otherwise you may disregard your engine limits inadvertently and thereby ask for trouble.

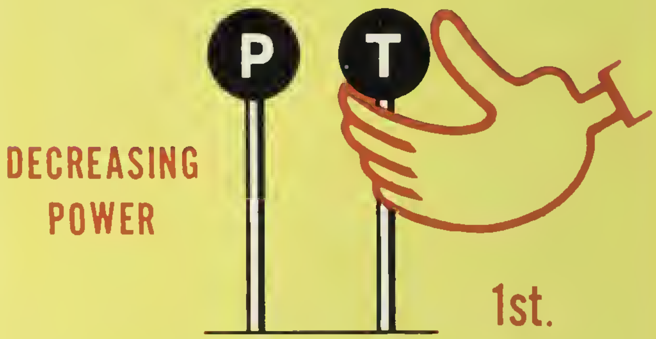
Some pilots lack a clear understanding of manifold pressure. Simply, it is the pressure expressed in inches of mercury (Hg) under which the fuel/air mixture enters the intake port of the cylinder of the engine. Never confuse it with the pressure within the cylinder.

Ordinarily you read your power output by refer-

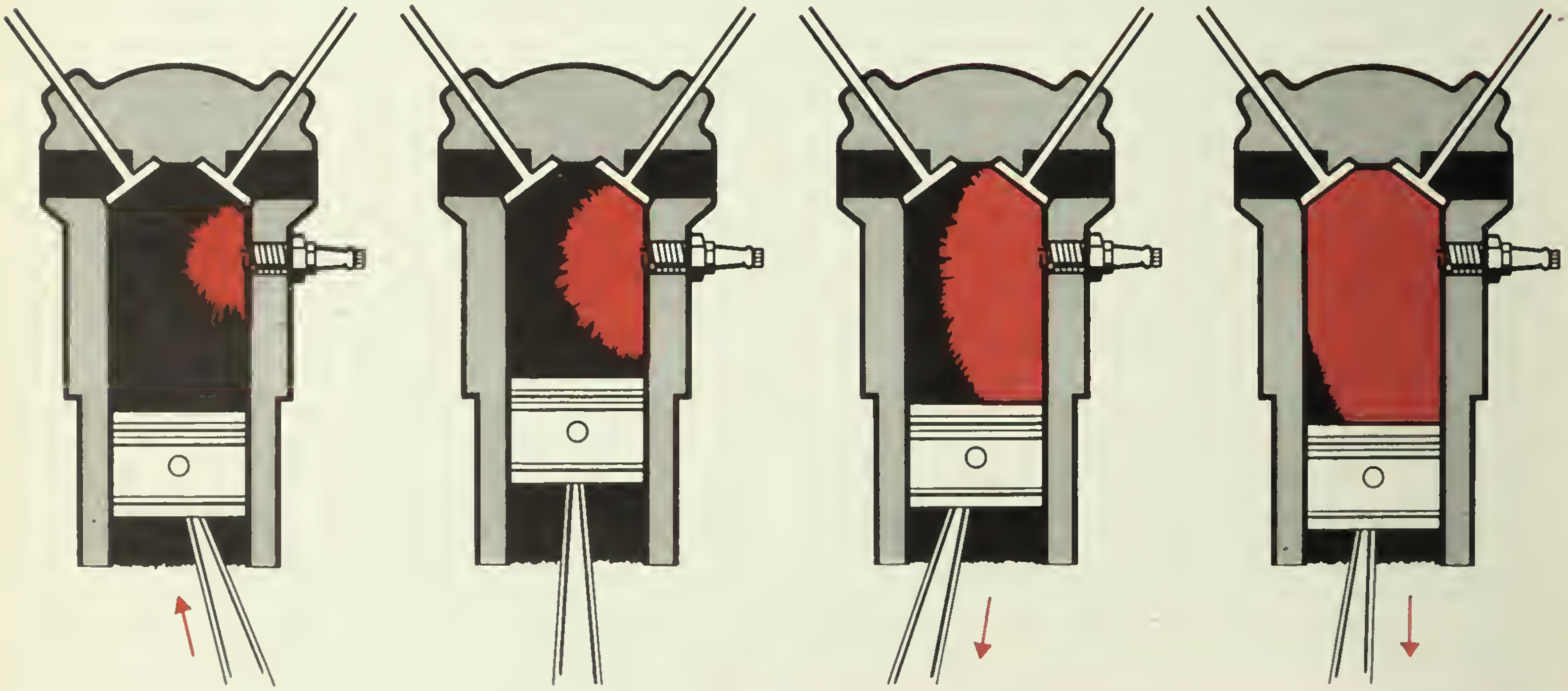
Recommended Sequence for Changing Power



Increase rpm before you increase throttle.



Decrease throttle before you decrease rpm.



NORMAL COMBUSTION

ring to your manifold pressure gage and tachometer. For a given manifold pressure there is a specified range of rpm settings which gives you efficient power output. If your rpm is below the specified range, you get an undesirable increase in BMEP and higher temperatures; if your rpm is above the specified range, your fuel consumption increases.

When you increase the throttle and allow your engine to produce more power, the constant-speed propeller takes a greater bite of air in order to absorb the extra power it is receiving from the engine.

Detonation

Detonation is the effect of an abnormal combustion of part of the fuel mixture. When detonation occurs, combustion is normal until approximately 80% of the charge is burning. At this point the combustion accelerates with great rapidity and the remaining part of the charge burns almost instantaneously, or explodes.

This explosion literally hammers the cylinder walls and piston and causes the knock you have heard in automobile engines, but which you cannot hear in airplanes because of other noises. Detonation subjects the engine to a series of shocks, which can cause engine failure.

Remember, when detonation is occurring your engine is not delivering its expected power.

The effects of detonation are accumulative. Mild detonation may not cause engine failure, but it may impair future operation seriously. Don't jeopardize the next pilot who flies the airplane. Report all engine trouble on your Form 1A at once.

Conditions Contributing to Detonation

Fuel of too low octane rating (grade).

High cylinder-head temperature caused by: prolonged climb at reduced airspeed; improper use of cowl flaps or coolant shutters; too lean a mixture.

High intake mixture temperature caused by: high outside air temperature; use of carburetor heat; improper use of intercooler shutters (if so equipped).

Improper mixture ratio caused by: too lean a mixture or malfunctioning of the carburetor.

Too high manifold pressure, with other conditions favorable to detonation.

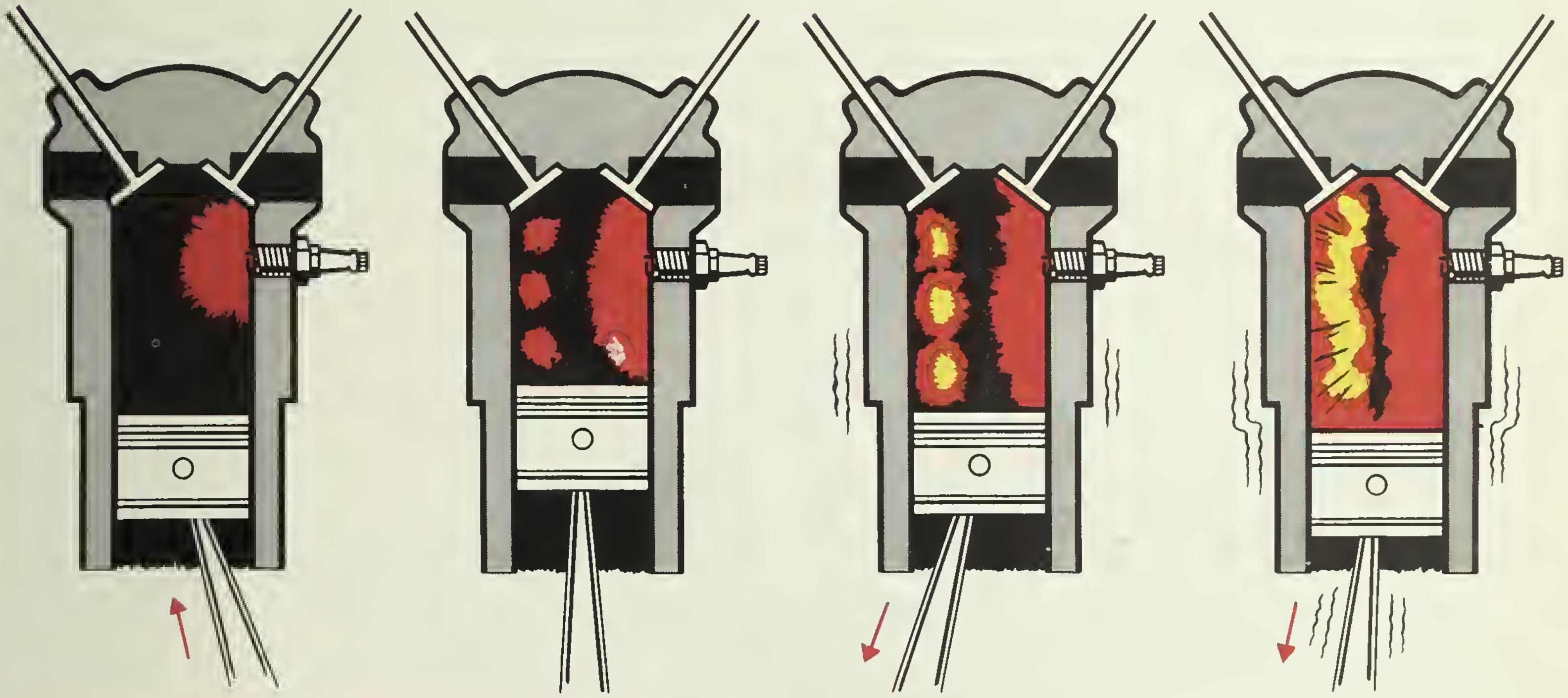
Symptoms and Remedies

Pilots often ask how to recognize detonation and what they can do about it. Unfortunately **there are no positive means by which a pilot can recognize it.** Here are some of the things that **may** indicate it:

Unusual roughness of engine.

Rapid rise in cylinder-head temperatures.

Erratic fluctuations in the fuel/air ratio reading (exhaust gas analyzer).



DETONATION

Intermittent puffs of dense black smoke from the exhaust stacks, which is accompanied by sparks or glowing carbon.

There are a few things you can do to eliminate detonation once you suspect it in flight:

1. Reduce manifold pressure.
2. Increase rpm.
3. If in lean mixture, enrichen it.
4. Open the cowl flaps or coolant shutters.
5. Check carburetor head and intercooler controls.

Carburetor Mixture Controls

Mixture control settings fall into two categories: manual and automatic. Automatic controls vary in design but their primary function is the same. They maintain a constant fuel/air ratio regardless of altitude (air density) changes.

Following is a list of the different types of mixture controls:

Manual Control: The fuel/air mixture is controllable from FULL RICH to IDLE CUT-OFF.

The following controls are automatic unless otherwise specified:

Three-Position Control: On one type of quadrant the settings are marked: FULL RICH, CRUISING LEAN, and IDLE CUT-OFF.

On another type of quadrant, settings are: EMERGENCY RICH, RUN, and IDLE CUT-OFF. When in the RUN position, the entire range is automatic and adapts itself to any power setting.

Four-Position Control: Settings include FULL RICH (this setting is manual), AUTO RICH, AUTO LEAN, and IDLE CUT-OFF.

IMPORTANT

Don't let the term EMERGENCY RICH confuse you. It has nothing to do with emergencies in flight. It applies to the carburetor only and you use it only when the automatic feature of the carburetor is not operating properly and producing a too lean condition. This setting doesn't give maximum power.

The uses and the interchangeable names of the carburetor mixture controls are as follows:

FULL RICH or EMERGENCY RICH: **Intended to be used only when the automatic features of the carburetor are not functioning properly.** This is because the setting has no automatic mixture feature (except in the Holley carburetor). **This setting is richer than best power mixture and you can't expect maximum power from it. No altitude compensation is possible.**

AUTO RICH or RICH: Used for takeoff and high-power conditions.

AUTO LEAN or CRUISING LEAN: Used for cruising or minimum fuel consumption.

IDLE CUT-OFF: Commonly used for stopping engines so that there will be no fuel left in the induction system. It stops flow of fuel within the carburetor.

RUN: Interchangeable for AUTO RICH or RICH and AUTO LEAN or CRUISING LEAN.

Pat Pat
Treat your engine right . . . an overhaul costs between $1000 and $10,000

FUEL

Fuels for AAF airplanes are:

Grade 73
Grade 80
Grade 87
Grade 91/96
Grade 100/130
Grade 115/145

A fuel's anti-knock or octane rating (the grade) is an index of its property to withstand detonation.

A number of years ago a standard was set up to represent the ideal fuel for high-compression engines. This was called 100 octane. It is the yardstick by which fuels are graded. For instance, a fuel graded as 91 octane was considered 91% ideal. Since then, fuels have been developed which are better than the 100 octane standard. For instance, grading a fuel as 100/130 indicates that the fuel in lean mixture is as good as the standard, but in rich mixture it is even better than the old arbitrary standard. Thus, on the higher grade fuels, the lower (left hand) figure represents the grade of fuel with lean (cruising) mixture settings, and the higher (right hand) figure represents the relative anti-knock rating at rich (high power) mixture settings.

The higher pressure a fuel can withstand in the cylinder without detonating, the higher its anti-knock rating.

There are, however, definite limits to which the mixture can be compressed. These limits are in the fuel itself.

If you use a fuel of anti-knock rating lower than that specified for the engine, there is danger of detonation. You can't use a low anti-knock fuel in a high compression engine or in a highly supercharged engine without causing serious trouble, **unless you stay within specific operating limits for that grade of fuel for that engine.** Since the explosions during detonation occur hundreds of times a minute, and since gasoline is ten times more powerful in explosive force than dynamite, you can imagine what happens to the cylinder in a short time during detonation.

Alternate Fuels

Although the previous paragraphs warn you against using fuel of lower anti-knock rating than that intended for your specific engine, there is one exception to the rule: In order that supplies of Grade 100/130 fuel be kept within monthly allotments, you may find that your airplane, even if it is designed to use 100/130 fuel, has been serviced with the next lower grade, 91/96.

With the lower grade fuel you have a set of lower operating limits. Know what these limits are and stay within them to avoid engine failure in flight.

A warning tag placed in a prominent place in the cockpit will call your attention to the substitution. The tag also indicates engine operating limits under this condition. For full details see T.O. 02-1-38 or other similar T.O. for your specific airplane. The proper T.O. should be placed in all airplanes permitted to use 91/96 fuel as an alternate.

Never fly an airplane serviced in this manner without knowing the engine limits the substitution imposes.

Caution

Always check fuel supply on the Form 1A before takeoff. Also check grade of fuel and be sure it is one that is permitted for use in your engine.

Aromatic Fuels

Most fuels of Grade 100/130 or higher are aromatic. Never use them in a fuel system not treated for their use. Markings on tanks of airplanes next to the filler cap indicate whether or not they are suitable for aromatic fuels.

Fuel-Vapor Return

On most airplanes there is a fuel return flow line from the carburetor to one of the tanks. In some airplanes this return flow may be as high as 20 gallons per hour. Know to which tank the excess fuel returns to avoid pumping the returned fuel overboard.

Reserve Fuel Supply

Reserve fuel supply is provided by two methods: a standpipe in a fuel tank or an auxiliary tank. Check instructions regarding the specific model and series of airplane you are flying for position of fuel tank selector valve.

Know the amount of reserve supply carried.

If valves are not in perfect condition drop tanks may collect additional fuel through gravity, even though you have already consumed the original load carried in the tank. If all of your fuel load is to be used, switch back to the drop tank periodically to use the returned fuel.

Fuel Tank Change-Overs

Don't let your fuel tanks run dry at any time unless maximum range is essential. Make your change from one tank to another in the specified sequence.

If it is necessary to burn almost all your gasoline before you make a tank change-over, watch for a drop in fuel pressure. If one occurs it indicates that fuel in that tank is almost exhausted. Usually it is a more accurate indication than a fuel gage.

In airplanes where fuel transfer systems are used consult the T.O. and the Pilot Training Manual for your particular plane.

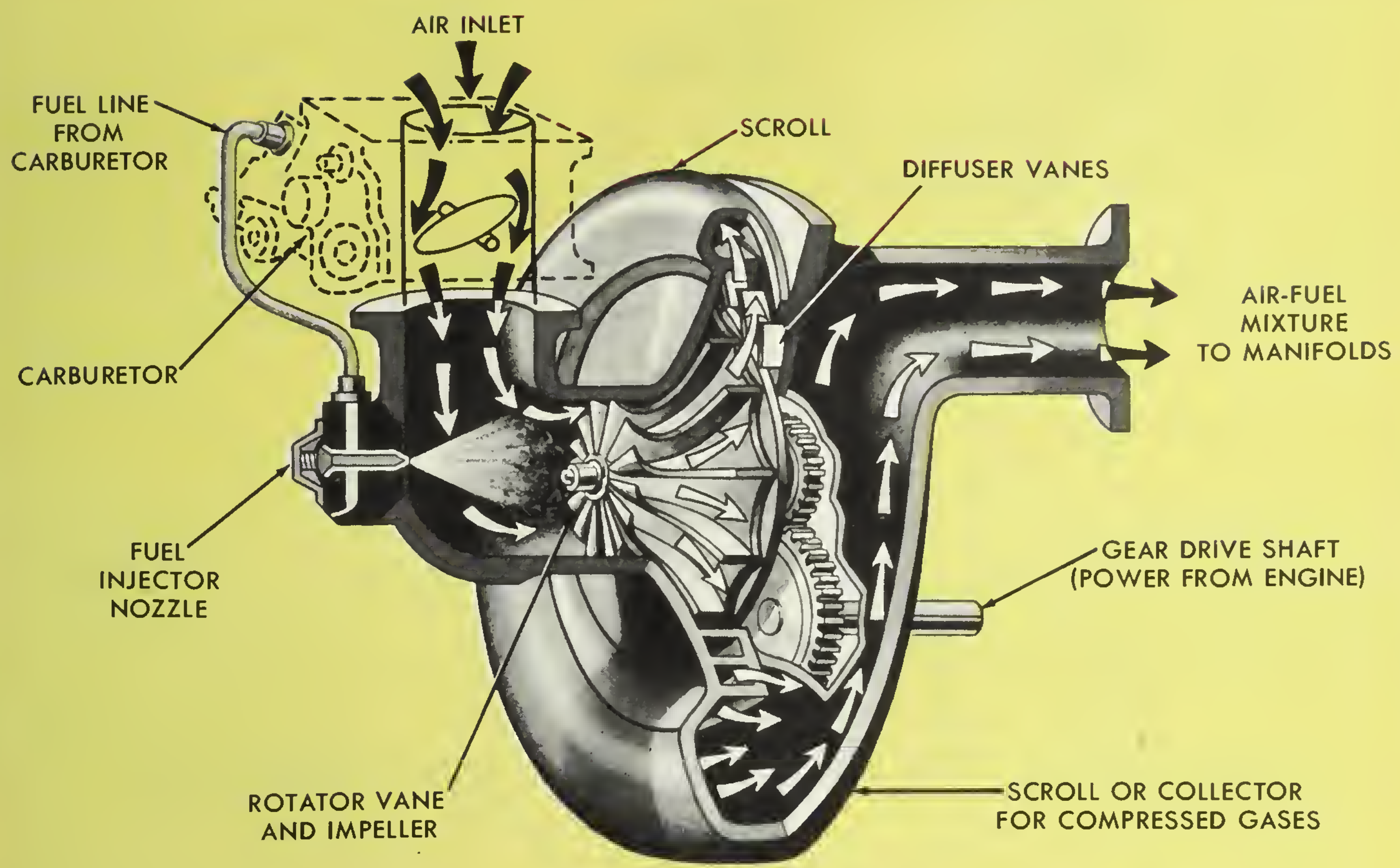
Feel the "Click"

Some multi-engine airplanes are equipped with crossfeed valves to permit one fuel pump to supply pressure to both engines, in case fuel pressure fails or becomes lower on one engine.

When you change tanks, make sure you feel the fuel selector handle click into place. (Do not rely merely on the position of the handle.)

Don't depend too much on your fuel gages. They are apt to be incorrect. Time your supply against known fuel consumption.

SUPERCHARGERS


AIR INLET
FUEL LINE FROM CARBURETOR
SCROLL
DIFFUSER VANES
AIR-FUEL MIXTURE TO MANIFOLDS
CARBURETOR
FUEL INJECTOR NOZZLE
GEAR DRIVE SHAFT (POWER FROM ENGINE)
ROTATOR VANE AND IMPELLER
SCROLL OR COLLECTOR FOR COMPRESSED GASES

CUTAWAY VIEW OF SUPERCHARGER

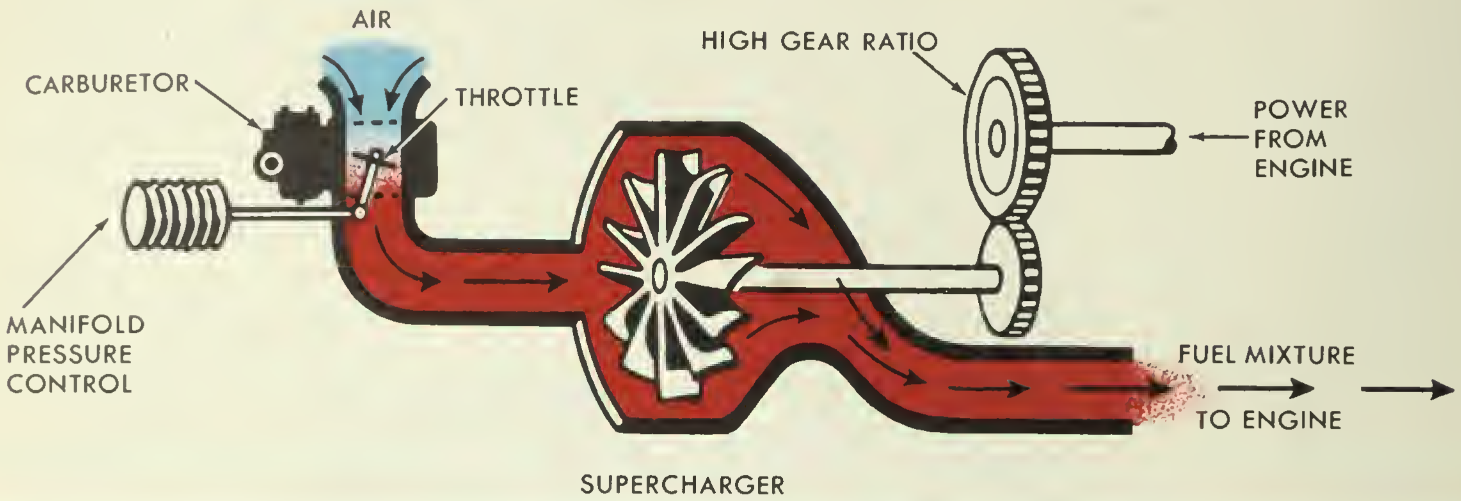
When a piston moves down on the intake stroke it creates a partial vacuum in the cylinder. Atmospheric pressure partly fills the cylinder with fuel/air mixture. To get an increase of power, however, it is necessary to increase the density of the mixture in the cylinder. To accomplish this the engine designer uses a supercharger to increase—or boost—the pressure above atmospheric pressure. He also obtains a slight additional pressure, or ram, by facing the carburetor air scoop into the airstream. Any additional pressure above atmospheric pressure, up to the mechanical limitations of the engine, results in a net increase in power.

Fundamentally, a supercharger is a fan or blower which forces more air and fuel into the cylinders. Superchargers are gear-driven by the engine except for the turbo-supercharger, which is driven by the exhaust gases of the engine. Some run at speeds upward of 20,000 rpm.

The mixture (or air in a turbo) comes in at the center of the supercharger and is compressed by centrifugal force. It then enters the cylinder.

This increase in power produced by the supercharger can't be considered clear profit. It takes some engine power to drive the supercharger. However, this apparent sacrifice in power is more than compensated for because the designer can keep down the weight of his engine (an important factor in aircraft design) by using a supercharger instead of building a bigger and heavier engine.

SINGLE-STAGE SUPERCHARGER WITH ONLY ONE SPEED



Types of Supercharging

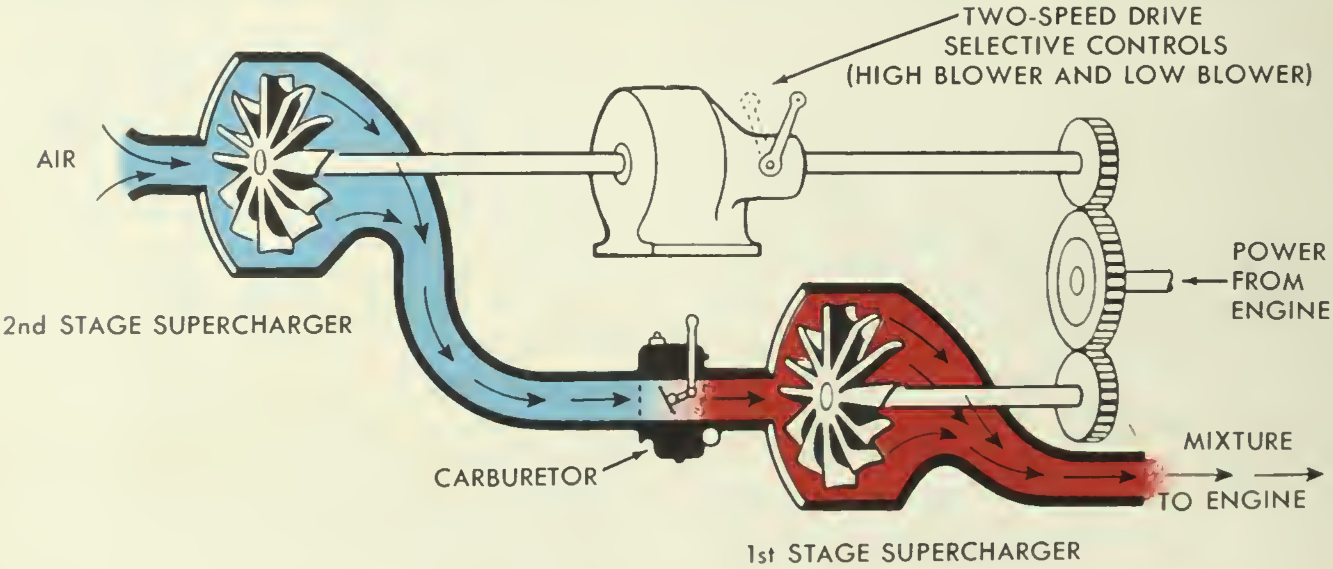
In gaining altitude without superchargers, power falls off as the air density decreases. Since the air is less dense at higher altitudes the engine must have a greater amount of it (actually a greater amount of its oxygen content) for proper combustion, just as you need oxygen at altitude. To supply this, superchargers are used in a variety of ways and in different arrangements. They are described in the words "stage" and "speed."

Stage refers to the number of times the air is compressed. Single-stage supercharging employs one impeller mechanism; two-stage supercharging uses two impeller mechanisms to compress the air more fully.

Speed refers to the rate at which the impellers are turning in relation to crankshaft and involves low blower operation for lower altitudes and high blower operation for higher altitudes.

Here are the different types of supercharger installations on AAF aircraft:

Single-Speed Supercharger: A gear-driven supercharger which forces mixture into the cylinders. It



TWO-SPEED, TWO-STAGE SUPERCHARGER

is an integral part of the engine and is located between the carburetor and the intake port.

Two-Speed Supercharger: A gear-driven supercharger with selective controls (high blower and low blower). You can use only one at a time. It is located between the carburetor and intake port.

Two-Speed, Two-Stage Supercharger: Two superchargers are used. One compresses air before it reaches the carburetor, and the other compresses the mixture after it leaves the carburetor. On one type of installation both impellers are located between the carburetor and intake port.

Turbo-Supercharger: A turbo-supercharger is an external unit consisting of a turbine, driven by exhaust gases of the engine, directly connected to a supercharger or blower. It compresses air ahead of the carburetor intake and is used in conjunction with a gear-driven supercharger. The speed of the turbine is regulated by a valve called the waste gate, which controls the flow of the exhaust gases.

Low Blower vs. High Blower

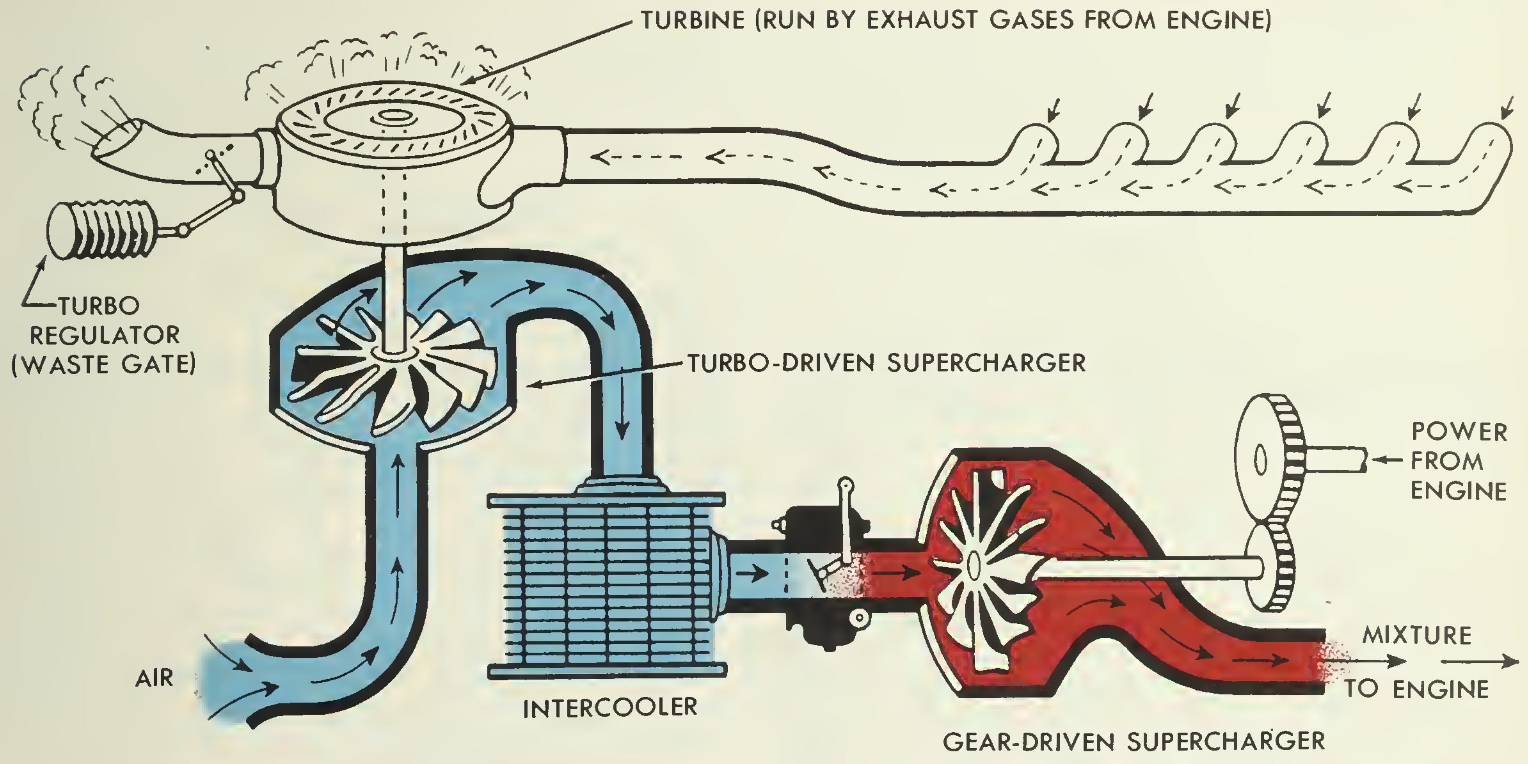
It takes more power to run a supercharger in high blower than in low blower. If the low blower furnishes you sufficient manifold pressure for the desired power setting, it is both inefficient and uneconomical to use high blower. Always be sure, therefore, that you know how much power your specific high blower operation requires and the lowest altitudes at which you should use it.

Cooling

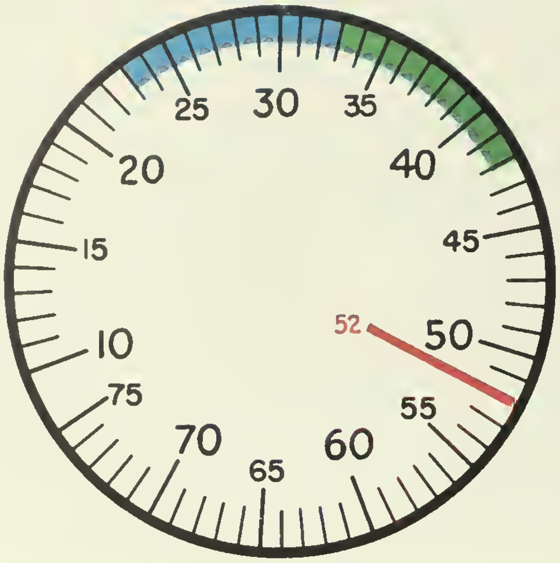
When air is compressed its temperature increases. In some supercharger installations it is necessary to cool the air as it passes from one blower to another. Since it is desirable for the mixture to enter the engine as cool as possible to insure maximum power, a device called an intercooler is used.

Diffusers

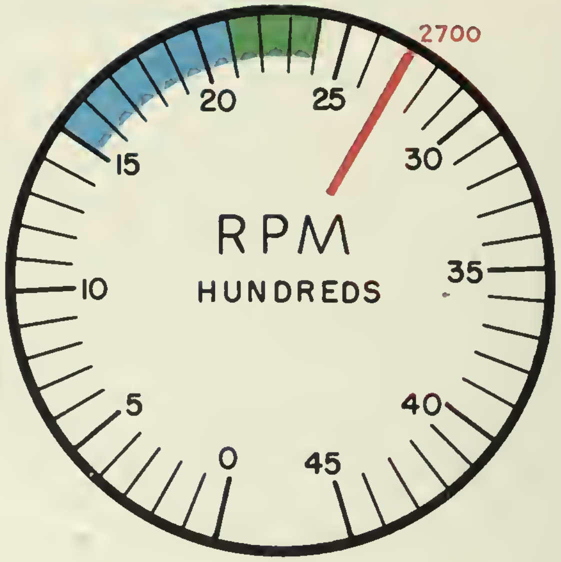
Some low-powered aircraft engines employ a diffuser. This is a low-speed blower located between the carburetor and the intake valve port. It mixes the fuel and air vapor more thoroughly before the mixture enters the cylinders. The diffuser also assures even distribution of the fuel/air mixture to all the cylinders. It does not increase the manifold pressure appreciably.


TURBINE (RUN BY EXHAUST GASES FROM ENGINE)
TURBO REGULATOR (WASTE GATE)
TURBO-DRIVEN SUPERCHARGER
POWER FROM ENGINE
MIXTURE TO ENGINE
AIR
INTERCOOLER
GEAR-DRIVEN SUPERCHARGER

TURBO-SUPERCHARGER WITH INTERCOOLER

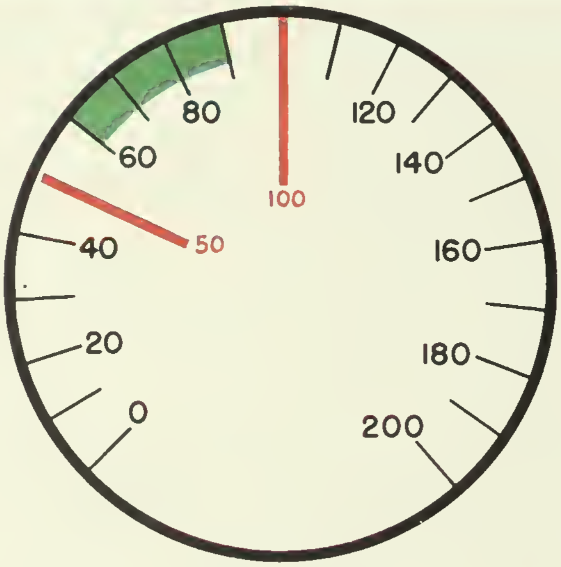


MANIFOLD PRESSURE

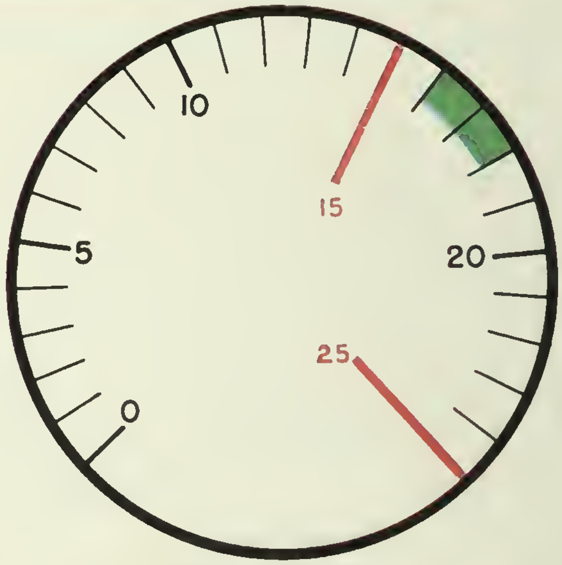


RPM

ENGINE INSTRUMENTS



OIL PRESSURE



FUEL PRESSURE

NOTE

Your airplane engine instruments may not yet be marked in the manner described here. It is the new standard system to be used in the AAF. Installations will be made as soon as possible.

To make proper operation easier, approved operating ranges and limits are marked on instruments in a four-color system. Conventional color symbols are used. Red denotes a limit or danger region, yellow denotes caution, and green denotes AUTO RICH operating limits. Blue, used on some engine instruments, indicates AUTO LEAN operating limits. These blue markings may appear on the tachometer, manifold pressure, and cylinder-head temperature gages, and also on the mixture quadrant at the lean position. The system is designed to indicate immediately when you can use lean mixture, with accompanying lower fuel consumption.

LEAN MIXTURE RULE

To operate in lean mixture it is essential that on instruments marked with blue all pointers concerned register in the blue arc. If any one pointer registers in a green arc, you must use rich mixture. (If cylinder-head temperature gage has no blue arc, this pointer should be in the green arc.)

Notice the placard on your instrument panel telling for what grade fuel the instruments are marked: POWER LIMITS ARE FOR GRADE----FUEL.

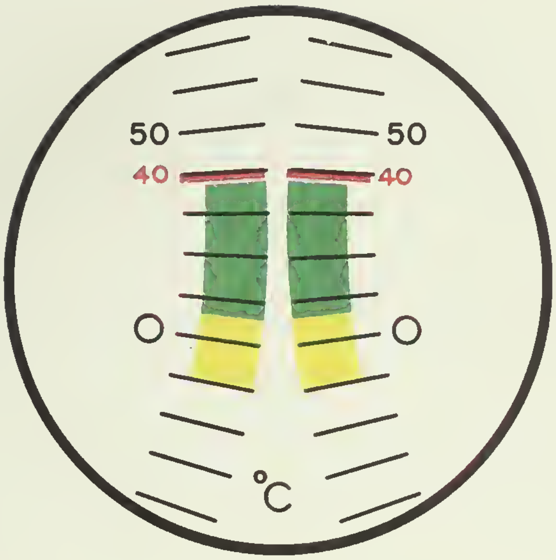
The **manifold pressure gage** has blue arc for lean operation, green arc for rich operation, short red radial line for takeoff or Military Power, and long red radial line for War Emergency Power, if your engine is so rated.

The **tachometer** has blue arc for lean, green for rich, and short red radial line for maximum permissible rpm.

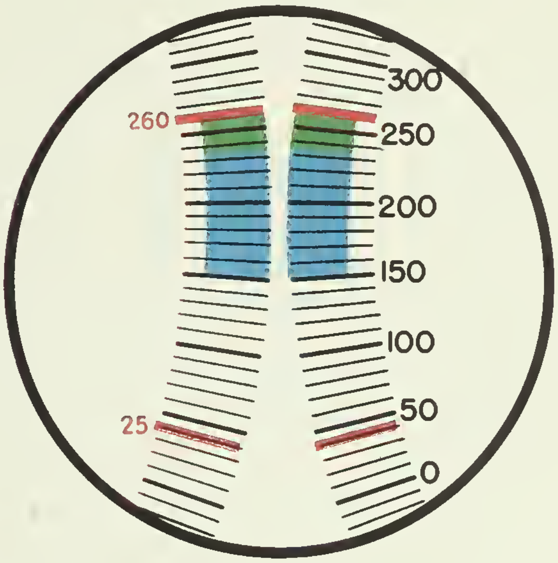
The **cylinder-head temperature gage** may have blue and green arcs for different mixture limits, or it may have simply a green arc for operating range. Red lines show minimum desirable cylinder-head temperatures for takeoff and maximum permissible cylinder-head temperatures.

The **carburetor air temperature gage** has a yellow arc to signify possible icing. Green indicates the desired operating range, and red shows the upper limit.

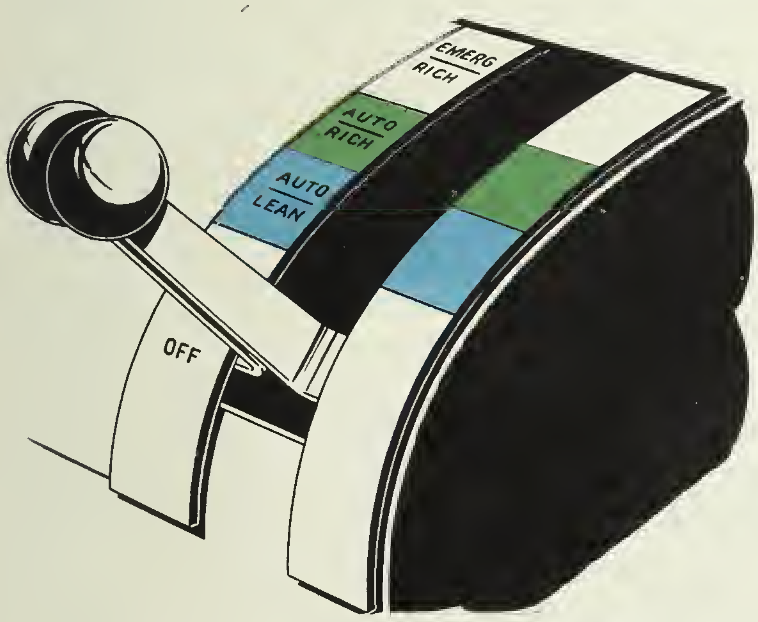
Other instruments are marked in conventional manner with green arcs for operating ranges and red lines for the maximum and minimum limits.



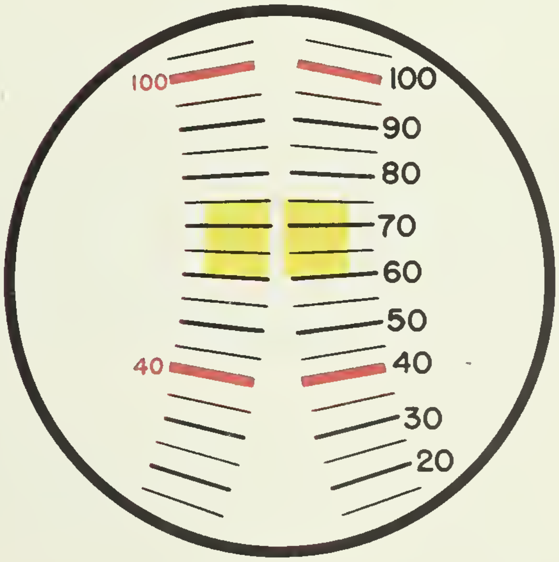
CARBURETOR TEMPERATURE



CYLINDER TEMPERATURE



TYPICAL MIXTURE QUADRANT



OIL TEMPERATURE

ELECTRICAL SYSTEM

The electrical system of an airplane is like a water pumping system. There are three main things to consider: source, distribution, and storage. Here's the comparison:

	ELECTRICAL SYSTEM	WATER SYSTEM
1. Source	Generator	Water pump
2. Distribution	Wire	Pipe
3. Storage	Battery	Storage tank

Different terms are used in an electrical system, although it functions like a water system.

Pressure = Voltage
Quantity = Amperes
Resistance = Resistance (in ohms)

Water, as it flows through the pipe, is resisted according to the roughness or smoothness of the inside of the pipe. The flow of electricity is resisted according to the size of the wire and the material of which it is made.

A water system has a drain-off pipe to return water to the reservoir. In an electrical system the return line consists of a ground through the airplane structure to the battery.

The electrical system affects not only the engine but also the hydraulic system, lights, instruments, communication equipment, and electric propellers.

Know what to expect if the electrical system of your airplane fails, and be able to cope with the situation. Such a failure doesn't mean that you must crash land or abandon the airplane.

The component parts of the electrical system follow:

The **generator** is the primary source of power for the entire system.

The **voltage regulator** keeps the generator voltage constant at all times.

The **voltmeter** measures the voltage from the generator after the voltage regulator has done its job.

The **generator switch** connects and disconnects the generator from the main circuit.

The **reverse current cut-out** automatically disconnects the generator from the main circuit when the engine stops or when the generator ceases to operate.

The **ammeter** measures the amount of electricity flowing through the lines. It measures the flow in amperes.

The **battery** is a small power reserve to supply extra power for momentary peak loads.

The **battery switch** connects and disconnects the battery from the main circuit.

Use of Auxiliary Power in Starting

Some airplanes obtain auxiliary power from a putt-putt, which is a generator driven by a gasoline engine. It is either carried aboard the airplane or used on the line. Other planes use a battery cart on the ground. **Use an auxiliary source of power for starting whenever practicable in order to conserve the airplane's batteries.**

Caution

If you have only one generator, start the engine first which operates the generator. Watch ammeter and increase rpm until the ammeter shows that the generator has cut in before you attempt to start another engine.

Important

Study the fuse diagram in the T.O. for your airplane. Know the location of all fuses, their functions, and how to replace them.

Know all emergency operation.

Make sure all switches are OFF before leaving the airplane.

Your battery is less efficient in cold weather.

Be sparing in your use of electrical equipment.

If anything goes wrong check fuse or circuit breaker first.

ELECTRICAL INSTRUMENT FAILURE

Inverters are used in many types of aircraft to change direct current (delivered by the battery system) to alternating current suitable for use in the Autosyn instrument system. Autosyn instruments, which are electrically powered, include certain engine instruments as well as landing gear and flap indicators.

Always check batteries and make sure generators are operating properly before takeoff. Failure of either may cause inverter failure, which will cause Autosyn instruments to fail, since they are dependent on inverter power.

Two inverters are supplied in most airplanes. Power can be drawn from either one.

Precautions

Don't flick the switch from one inverter to another in flight. Run on one inverter only. Save the spare until you need it.

If instruments do not function normally, or cease to function, turn the inverter switch to the spare inverter.

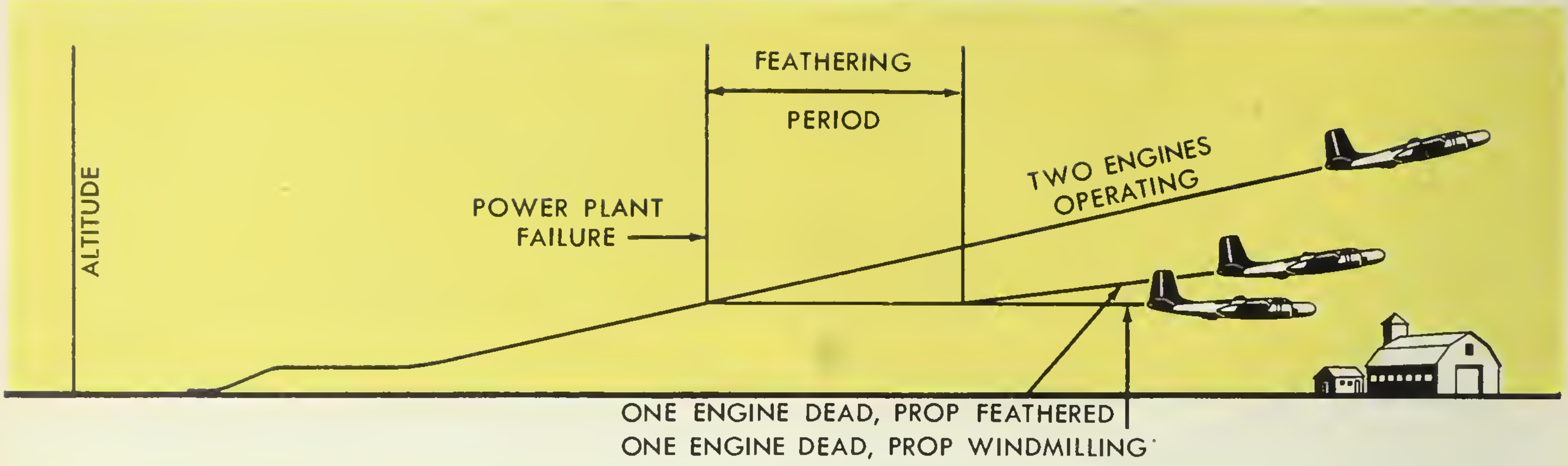
In the event your Autosyn instruments still do not function—even after trying the spare inverter—do not become alarmed. You can make a normal landing after reaching a suitable landing field if you:

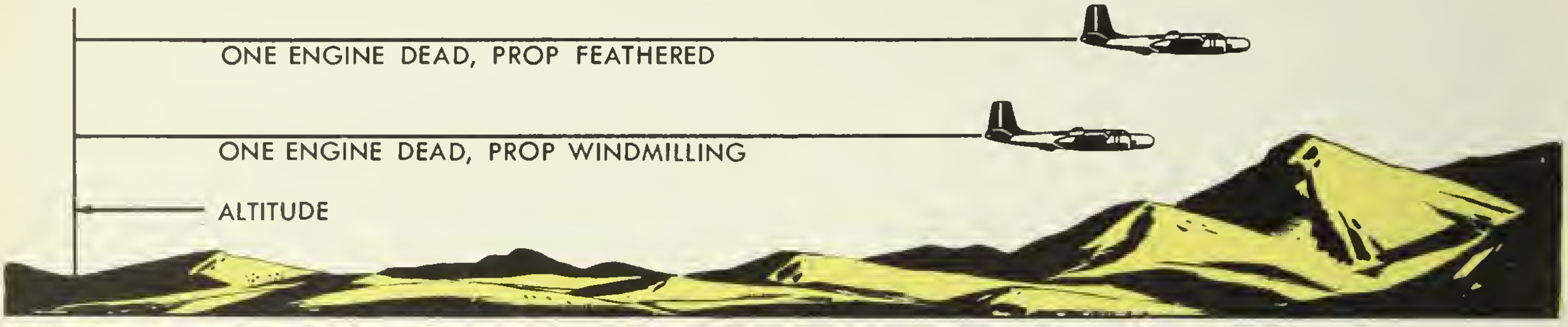
1. Reduce power and set engines by eye and ear, using flight instruments, which are not dependent on the inverters.

2. Extend landing gear and flaps and check them visually.

In case of inverter failure, remember your engine instruments will be inaccurate. For instance, on takeoff with 2700 rpm, the tachometer would not indicate reduction of rpm although it actually occurs each time you move the control toward DECREASE RPM. This is also true of the manifold pressure gages and other instruments, providing they are Autosyn instruments. The sound of your engines will tell you whether you are having merely inverter failure or actual engine trouble.

Don't bail out or feather just because your electrical instruments fail—you can still make a normal landing!


FEATHERING
PERIOD
ALTITUDE
POWER PLANT FAILURE
TWO ENGINES OPERATING
ONE ENGINE DEAD, PROP FEATHERED
ONE ENGINE DEAD, PROP WINDMILLING


ONE ENGINE DEAD, PROP FEATHERED
ONE ENGINE DEAD, PROP WINDMILLING
ALTITUDE

FEATHERING

Most constant-speed propellers incorporate a feathering feature. Feathering a propeller permits the stopping of a disabled and vibrating engine, decreases the drag of a windmilling propeller, and increases the performance of the airplane with the remaining engine or engines.

If the feathering mechanism fails, or if the propeller is not equipped with a feathering feature (or during simulated engine failure), the pilot should place the propeller control in the low rpm position. Even though you cannot feather the propeller you can eliminate a high percentage of drag with the prop in the low rpm position.

If necessary to maintain level flight, increase the propeller and throttle settings of your operating engine or engines, but don't exceed the maximum permissible limits of the engine.

To Feather or Not

Indications which might cause you to feather an engine fall into three main categories. Avoid confusion by knowing which indications call for immediate feathering and which call for another procedure.

Case 1: Engine instruments indicate trouble but there is no yaw and no visible damage to the engine. For instance, the indicated oil pressure drops to zero, but oil temperature and cylinder-head temperature remain constant. There is no excessive amount of oil on the cowling or wing which might indicate a broken oil line. Perhaps only the oil pressure gage has failed. Don't feather unless there are other indications that it is necessary. A cross-check of engine instruments should tell you.

Case 2: A yaw toward the side of the failing engine indicates loss of power, but there is **no visible damage to the engine.** Your decision on whether or not to feather should then depend on what your instruments tell you.

If the difficulty involves cooling or lubrication (oil temperature, oil pressure, or cylinder-head temperature) you should feather while you still can. Excessive heat may eventually start fire or freeze the engine. Lack of oil generally freezes an engine within 60 seconds.

If the difficulty is in the fuel system, delay feathering. Lack of fuel pressure may indicate either a faulty fuel pump or a dry tank. Try tank change, crossfeed, booster pumps.

If you have fuel pressure and your temperature instruments are reading normally, the automatic feature of your carburetor may be out; if so, go to FULL RICH or EMERGENCY RICH. Sometimes an engine backfires or cuts out when operating in

Important

If you decide to feather make sure you feather the correct engine. When there is yaw, the engine to be feathered is always on the side toward which the needle of your bank-and-turn indicator points, and opposite to the rudder you have to hold to keep the airplane straight. If you are still not sure, try reducing the throttle on the engine you suspect; if you are suspecting the correct engine there should be no appreciable increase in yaw.

lean mixture settings. Try correcting this difficulty by enrichening the mixture before you decide to feather.

Don't fail to check all electrical switches which you might have tripped inadvertently.

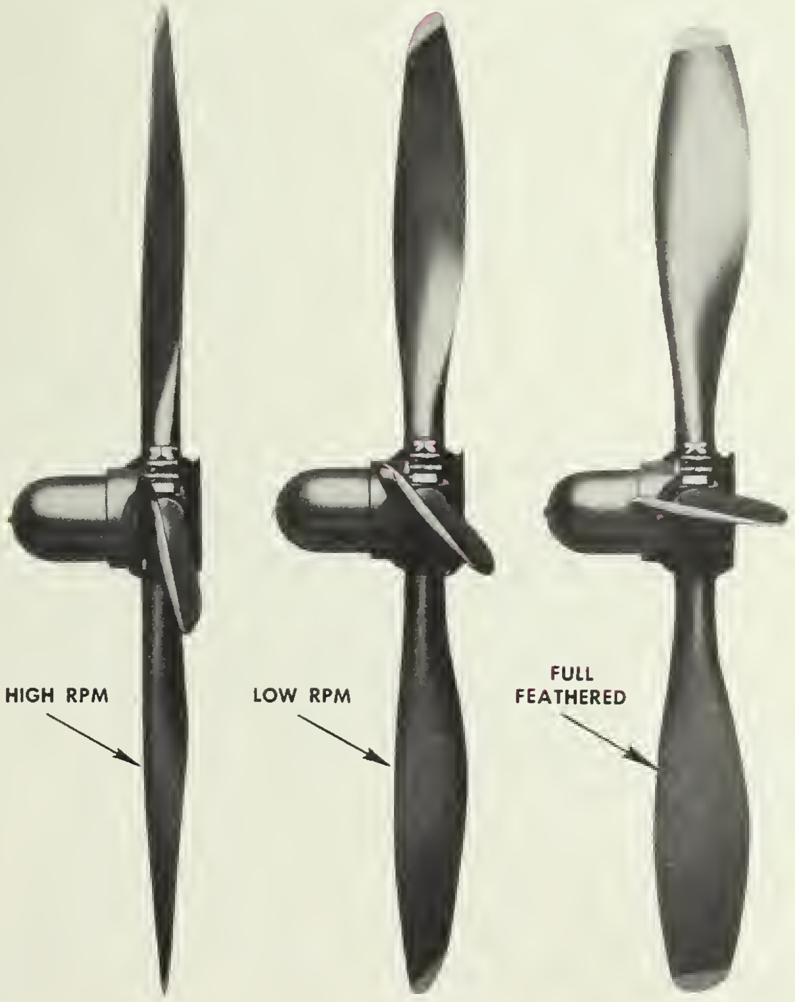
Case 3: A yaw indicates loss of power and this is **accompanied by visible damage to the engine,** such as smoke, fire, excessive vibration, or visible structural failure (cylinder heads blown through cowling). The general rule is to feather immediately, and if there is a fire, to follow fire procedure.

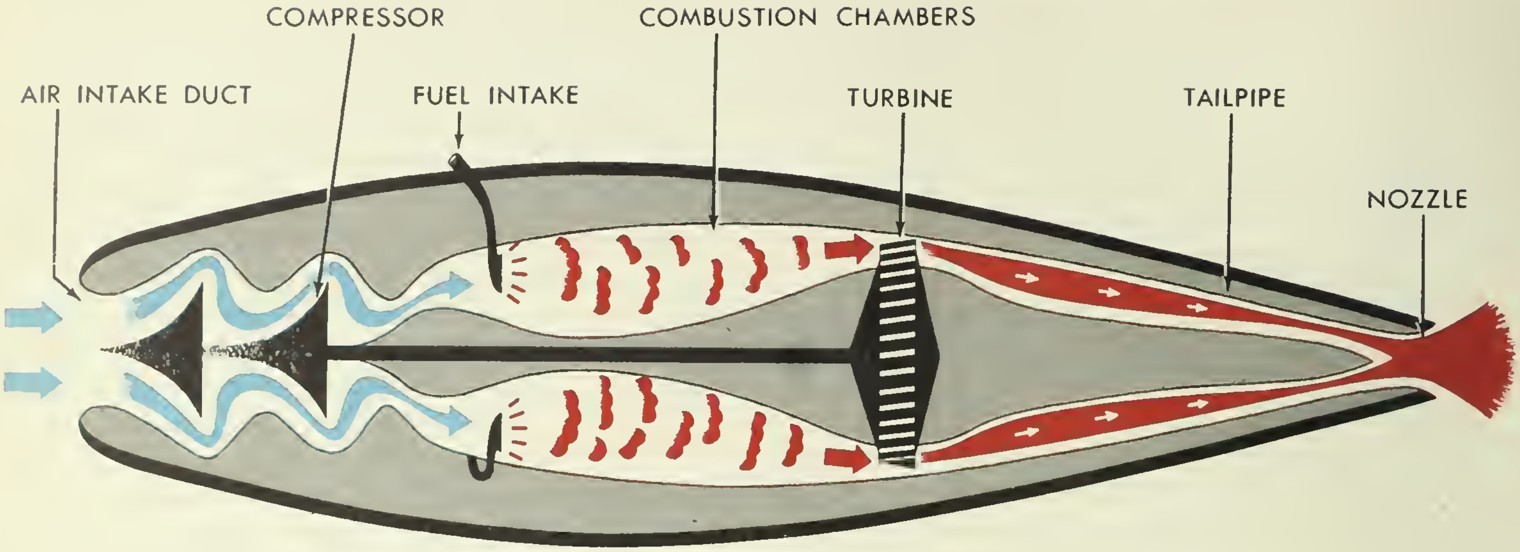
There are rare situations where an engine continues to deliver power even though there is visible evidence of structural damage. If you are in an emergency situation which demands all available power, you may be able to continue operation with that engine instead of feathering. You can determine that the engine is still producing some power if when advancing and retarding the throttle you notice a simultaneous difference in yaw.

Runaway Props and Feathering

A runaway propeller does not always call for immediate feathering, except when there is visible sign of an oil loss and oil pressure is going down while oil temperature is rising. Try handling the situation by reducing the throttle to a point where engine speed is under control and the engine is still delivering an appreciable amount of power.

After this there are several things you can do to secure proper propeller operation again. Consult the specific T.O. and the Pilot Training Manual for your airplane, to learn these procedures.





JET PROPULSION

Jet propulsion, which eliminates the use of propellers on airplanes, is not yet widely used in the AAF. It is likely that many more versions of the jet-propelled airplane, or the JP as it sometimes is called, will make their appearance in the future.

One important reason for the development of jet propulsion is that the fast modern airplane when it reaches speeds around 400 mph is affected by compressibility earlier than it would be otherwise, because of the propeller.

The JP apparently is limited in speed only by flying so fast that the air foils are subject to compressibility. This problem has not yet been whipped. The JP does not reach its full operating efficiency under 400 mph. Data on the highest speeds reached by a JP has not been released.

You have seen the jet-propulsion principle work on a toy balloon. If the balloon is blown up and then released suddenly the air rushing out of the neck of the balloon causes it to fly about. This is an example of a simple physical law: every action produces a reaction equal in force and opposite in direction.

The illustration here, though not representative of an actual engine or mechanically accurate in its details, pictures the principle of a jet-propulsion engine. In flight, air rushes in through the air intake ducts and enters the fan blades of a compressor. The compressor whirls it into combustion chambers at increased temperatures. Fuel is injected into the chambers and the mixture is ignited. The resulting gases flow through a turbine and from there to tailpipes where they are nozzled down and where they attain the great speed which gives the airplane its propulsive force.

As the ignited gases flow past the turbine, they drive it at high speed. The turbine is connected directly to the compressor by a shaft and in turn drives it at such speed that sufficient air is forced into the combustion chamber to supply the fuel with the oxygen needed for combustion.

To start the compressor there is an electric motor, geared to the single shaft, which turns it over so fast that the engine becomes self-operating in approximately 15 seconds.

High grade fuel is not needed for a JP. Kerosene has been used most often up to this time. Someone has said the JP will fly on "anything from coal oil to Napoleon brandy."

The JP has no continuous ignition so there are no electrical disturbances to radio transmission. Since there is only one main moving part, lubrication is exceptionally simple.

The JP becomes more efficient the higher it flies. The engine's adaptability to temperature extremes is another of its remarkable features. Pilots flying the JP in test flights have reached outside temperatures as low as 68° below zero without ill effect on the engine.

The rocket airplane also uses the jet propulsion principle. But it differs from the thermal jet chiefly in that it carries its own supply of oxygen, necessary for combustion; whereas the JP engine draws its oxygen out of the atmosphere.

WATER INJECTION

A War Emergency Rating for an engine, as explained earlier in this section, is established for combat use only. When you use it the engine is being stressed beyond its normal design limit, and in some cases you are utilizing completely the safety factor normally incorporated in engine design.

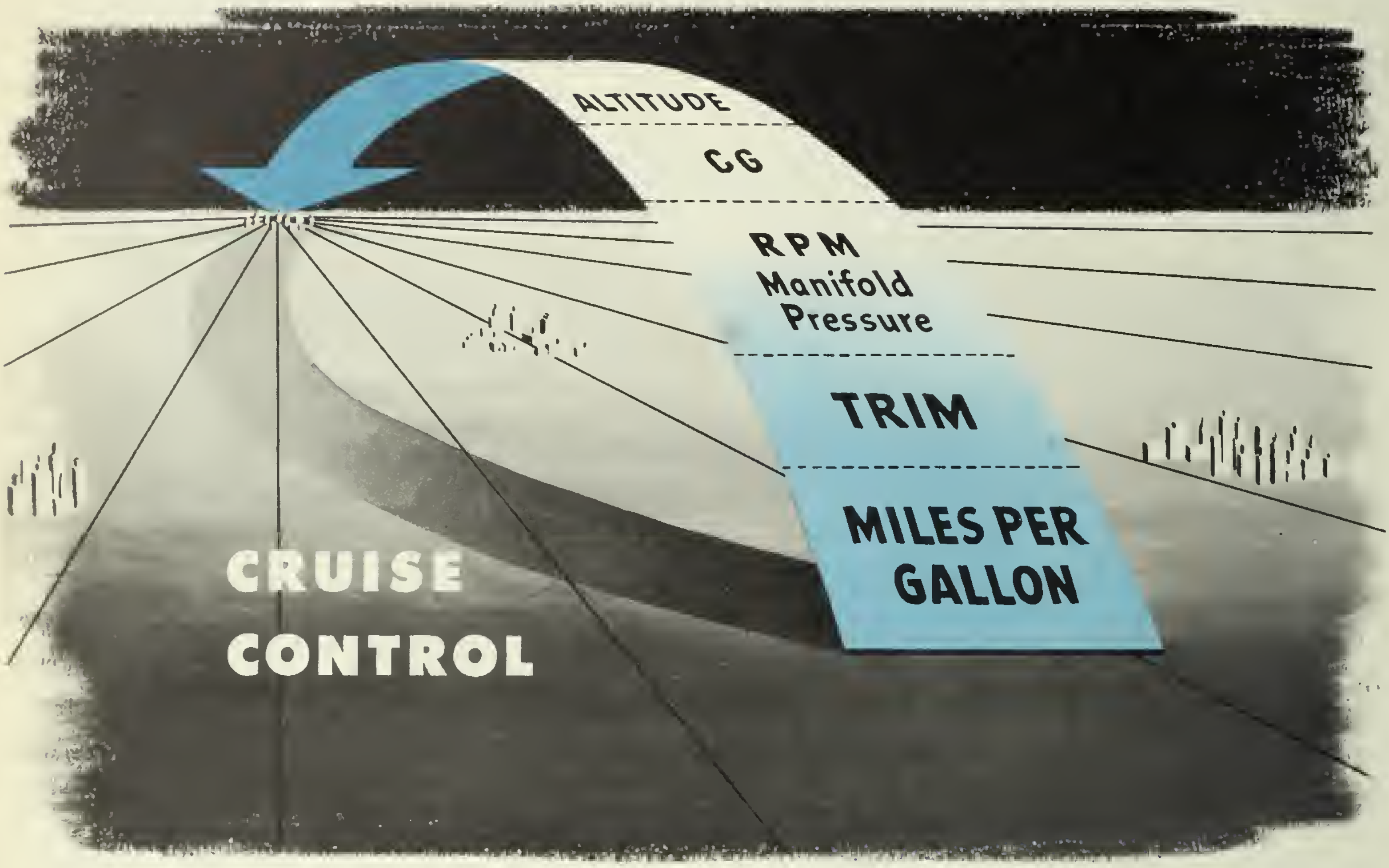
To obtain higher War Emergency Ratings the designer turns to the principle of water injection.

Water injection systems, which have somewhat the same beneficial effect on aircraft engines that damp weather has on automobile engines, shoot a fine spray of water into the cylinders. This suppresses the detonation that would otherwise result under such extreme uses of power. It also permits more economical use of fuel.

The water is injected into the fuel induction system, enters the cylinder and passes out as a vapor, eliminating undesirable heat which might otherwise cause a too quick burning of fuel.

Water injection reduces mixture temperatures and therefore reduces chances of detonation when the fuel itself is the limiting factor in obtaining additional power. It reduces peak combustion temperatures, thereby helping to cool the engine when additional power depends on engine cooling.

The pilot uses a War Emergency Rating to obtain a quick burst of speed, either to close in on the enemy or to evade him. He must consider water injection as ammunition which he expends without hesitation, but only when the occasion demands.



CRUISE CONTROL

Cruise control is often misinterpreted to mean only "the most miles per gallon of fuel." Proper control of the power plant under any given condition—maximum range, maximum sustained speed, or any intermediate cruise condition—is cruise control also.

Some of the factors affecting cruise control, which the pilot can regulate, are: rpm, manifold pressure, CG location, mixture control, altitude, and trim.

The subject of cruise control is not simple. It involves knowledge of engine principles, aerodynamics, navigation, and meteorology. You use cruise control so that you can operate your airplane within all limits on airspeed, power settings, and temperatures and at the same time as safely and (on long-range missions) as economically as possible.

Depending on the type of airplane involved, different procedures are required. In general, any pilot flying at or near maximum possible flight distance of his airplane realizes both good economy and good pay load only by using maximum range procedure. Flights of less than maximum range may call for progressively increasing power, resulting in poorer economy but better flight time.

Maximum range cruising is the most complicated form of cruise control. This is true because on a relatively long distance flight the gross weight of the airplane decreases as you use fuel. As this occurs you must decrease airspeed and lower power settings to obtain maximum economy.

For instance, in flying an airplane like the B-25 for a 1500-mile trip the only possible way to achieve good pay load is to use maximum range procedure.

Contrary to airlines flying in which the pilot flies the same itinerary constantly and has set up for him exact operating instructions for each leg of his flight, military airplanes are flown everywhere for varying distances. Some days you fly long distances and on others you make short hops. **The best way for you to learn cruise control for a long flight is to practice it on your short ones.**

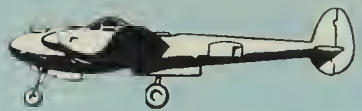
All Air Transport Command pilots on long missions fill out a special flight plan and range control chart in addition to their regular Form 23. Other AAF pilots, by studying this form and perhaps using it on their own long hops, could learn a practical application of cruise control. See your Operations Officer for latest forms and data on cruise control.

Different methods of cruise control are being taught at the present time. You will be told what system to use, but unless specifically instructed to use another system, use the one in the T.O. for your airplane.

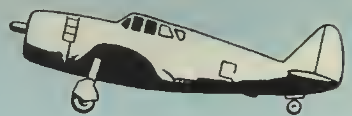
L-5 ★ CONVENTIONAL FLAPS

P-40 ★ SPLIT FLAPS

P-51 ★ CONVENTIONAL FLAPS



P-38 ★ FOWLER FLAPS

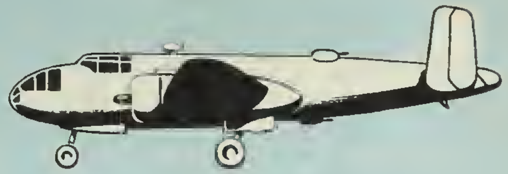


P-47 ★ FOWLER FLAPS

P-61 ★ FOWLER FLAPS

CG-4A ★ NO FLAPS

A-26 ★ FOWLER FLAPS



B-25 ★ FOWLER FLAPS

B-26 ★ FOWLER FLAPS

B-24 ★ FOWLER FLAPS

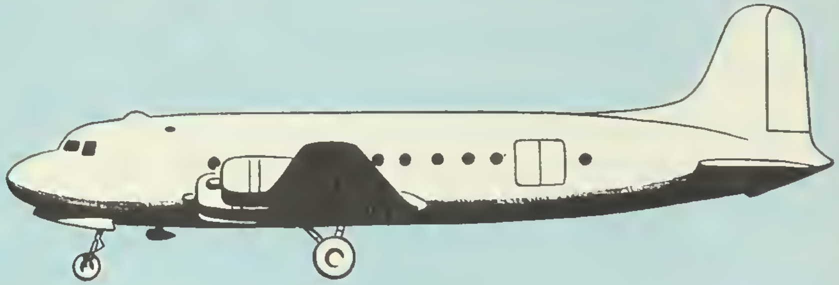
B-17 ★ SPLIT FLAPS

B-29 ★ FOWLER FLAPS

B-32 ★ FOWLER FLAPS

C-47 ★ SPLIT FLAPS

C-46 ★ FOWLER FLAPS



C-54 ★ FOWLER FLAPS

SECTION 6 THE AIRPLANE

TRICYCLE LANDING GEAR

Aircraft equipped with a nosewheel have several advantages over the conventional types: they do not ground loop; they have an approximately normal flight attitude on the ground, providing better visibility while taxiing; and they don't nose over when you apply brakes too heavily.

The nosewheel is not steerable on most planes. It tends to roll straight like a bicycle which is being ridden hands off.

Taxiing

You know how hard it is to turn the front wheels of an automobile when it is standing still. A nosewheel on an airplane at rest is just as hard to turn because so much weight rests on it.

When you get rolling, however, ground friction is reduced to almost nothing, and the nosewheel is free to right itself, if necessary, or to change direction if power is applied unevenly.

Don't rev up your engine or engines in an attempt to pull away from a dead halt. You increase the thrust on the nosewheel, making it harder to roll. Give the airplane its head by gradual, even, revving up, without using brakes. If you have a sufficient slipstream, use your rudder to change direction.

Takeoff

You get a nosewheel airplane off the ground more easily and at slower speeds by **pulling the nose off.** Since the center of gravity is forward of the main wheels, most nosewheel planes do not tend to fly themselves off, as do most conventional types.

The ordinary procedure is to raise the nose at 80% of takeoff speed. At this speed you can raise the nose sufficiently to produce a convenient angle of attack with a normal climbing attitude, and the airplane breaks away from the ground freely when you reach the proper airspeed.

Landing

Keep the nose up until the main landing wheels touch the ground. If the nosewheel is held off after landing, producing a greater angle of attack and more drag, it soon settles to the runway normally. Use brakes only as needed to stop at your predetermined position.

Tips

Note the nosewheel position before entering the plane. Check the locking pin.

If the nosewheel is cocked more than 30° use a bar to straighten it.

Anticipate turns sooner than with conventional gear by speeding the outside motor well before you make the turn and applying the inside brake easily, if necessary.

Stop with the nosewheel straight if possible.

Crosswind effect is negligible in landing nosewheel airplanes.

Windvaning effect is sometimes opposite to that in conventional aircraft.

Keep the nose up until the main wheels touch the ground.

Landing Wheel BRAKES

When you use brakes excessively or repeatedly without allowing them sufficient time to cool, you increase temperatures high enough to cause complete breakdown of the brake structures. Also you can cause brake drum and wheel structure failure, tire and tube blowouts, and even fire in the brake and wheel installations.

Ground Maneuvering

Use brakes as little and as lightly as possible to control the airplane while taxiing. For this purpose, whenever you can, use engines on multi-engine aircraft and the steerable tailwheel, where provided, on single-engine aircraft.

BRAKE PRECAUTIONS

Don't ride your brakes when taxiing.

Don't use your brakes to stop the airplane quickly unless it is absolutely necessary. Use all the runway possible on the landing roll.

Don't use brakes to speed up a turn unless you are trying to avoid some obstruction.

Allow at least 15 minutes between landings, with landing gear extended into the slipstream, for brakes to cool. If you retract the gear allow 30 minutes between landings. These time intervals may vary for different airplanes.

Don't set your parking brakes while they are still hot. They may freeze.

Don't pivot on one wheel. It injures both the strut and the tire.

Be careful not to apply toe pressure to brakes inadvertently when you work rudder pedals.

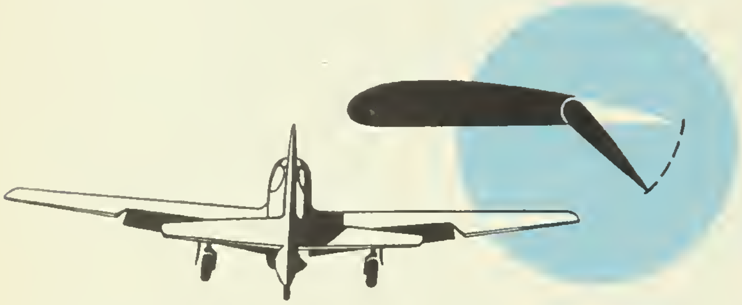
If your airplane is equipped with disc-type brakes don't set and lock them in flight. You can stop objectionable vibration caused by rotation of wheels not having disc-type brakes by applying brake pressure momentarily.

IMPORTANT

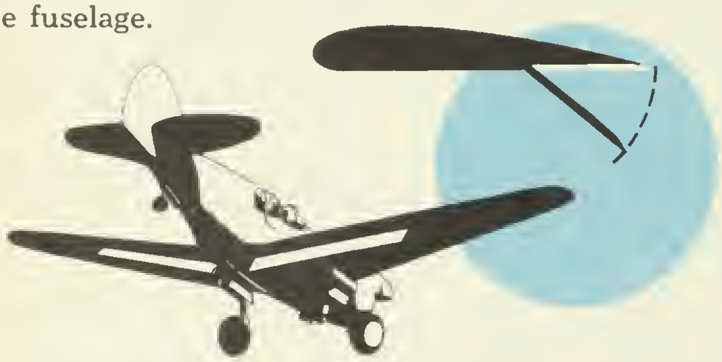
Be sure you know proper operation of emergency brakes. Always test your brakes before taxiing and report any improper functioning immediately. See the T.O. and Pilot Training Manual for your airplane for specific instructions on the use of brakes.

FLAPS

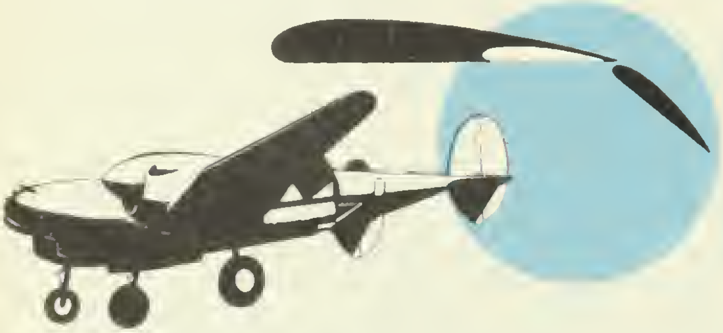
The three main types of flaps installed on AAF aircraft are:



Conventional: A hinged section of the trailing edge of the wing, located between the aileron and the fuselage.



Split: A hinged section of the under surface of the trailing edge of the wing. As its name implies, it splits the trailing edge.



Fowler: A separate unit which slides out of the wing, moving to the rear and then downwards.

Dive flaps are used on some types of fighter aircraft to keep the airspeed within safety limits in vertical or near vertical dives.

Depending on the type of airplane on which they are installed and their setting, flaps can produce both drag and lift, or merely drag without lift.

It is impossible to generalize about flap settings. Different airplanes, although equipped with the same type of flaps, may require that they be used differently. Know what effect the flaps have on your airplane at all settings. Consult the Pilot Training Manual and the T.O. for your airplane for correct procedures.

Important

The primary purpose of flaps is to steepen the gliding angle, not to decrease gliding speed. Flaps have a braking effect during the landing roll.

Clearance with Flaps

Generally, an airplane with flaps in takeoff position clears an obstacle by a greater margin than when flaps are not used. The takeoff run itself may be increased, but there is no hard and fast rule which applies. It is determined by the characteristics of the specific airplane you are flying, and is covered in the approved operating procedures.

Flaps and Fuel Economy

Incredible as it seems, accidents have occurred when pilots used flaps because they were running short of fuel. Flaps always produce drag and consequently increase fuel consumption.

Caution

If you have engine failure in multi-engine aircraft in a maximum performance climb following takeoff, lower the nose, increase airspeed, and milk up flaps. This improves directional and longitudinal control and reduces chances of stalling.

Tips

Don't lower flaps at an indicated airspeed higher than the limiting airspeed for flaps which is posted in the cockpit.

In making an approach where a go-around may be necessary you may need only partial flaps.

Use flaps cautiously on low-winged aircraft on rough ground or on fields covered with mud, puddles, or slush. Don't taxi such aircraft with flaps down because of the possibility of the flaps being damaged by objects thrown against them by the landing gear or the propeller.

Check flaps frequently for alignment and dents or holes.

Avoid puddles and slush whenever possible when landing or taking off with flaps down.

On your final pre-takeoff check always test your flaps for free operation.

TRIM

Trim tabs are the pilot's Man Friday. Their main purpose is to save you work. Remember, your airplane is always trying to do something you don't want it to do, unless properly trimmed. A trim tab is actually the control surface of a control surface.

Any change of attitude, power setting, or airspeed ordinarily requires re-trimming if you want to avoid fighting the controls. Other factors which influence trim are: the number and placing of crew members, the location of the cargo, and the constantly changing weight of fuel in your tanks. Proper trim also is an important factor in cruise control; it aids you in conserving fuel.

Before Takeoff

On pre-takeoff check be sure trim tabs are in takeoff setting.

Trim Tabs in Dives

It is extremely important for fighter pilots to know the effect of trim tabs on their airplanes in a high-speed dive. Since you must make any adjustments in trim during this maneuver with great caution and since the effect varies with different airplanes, consult specific operating procedures to know precise settings required. (See PIF 2-21.)

Trim and Autopilot

Check trim constantly when flying on autopilot. The tendency of many pilots is to fly too long on autopilot without re-trimming, since they cannot feel the pressures on the controls. **Always disengage the autopilot before you re-trim the airplane.**

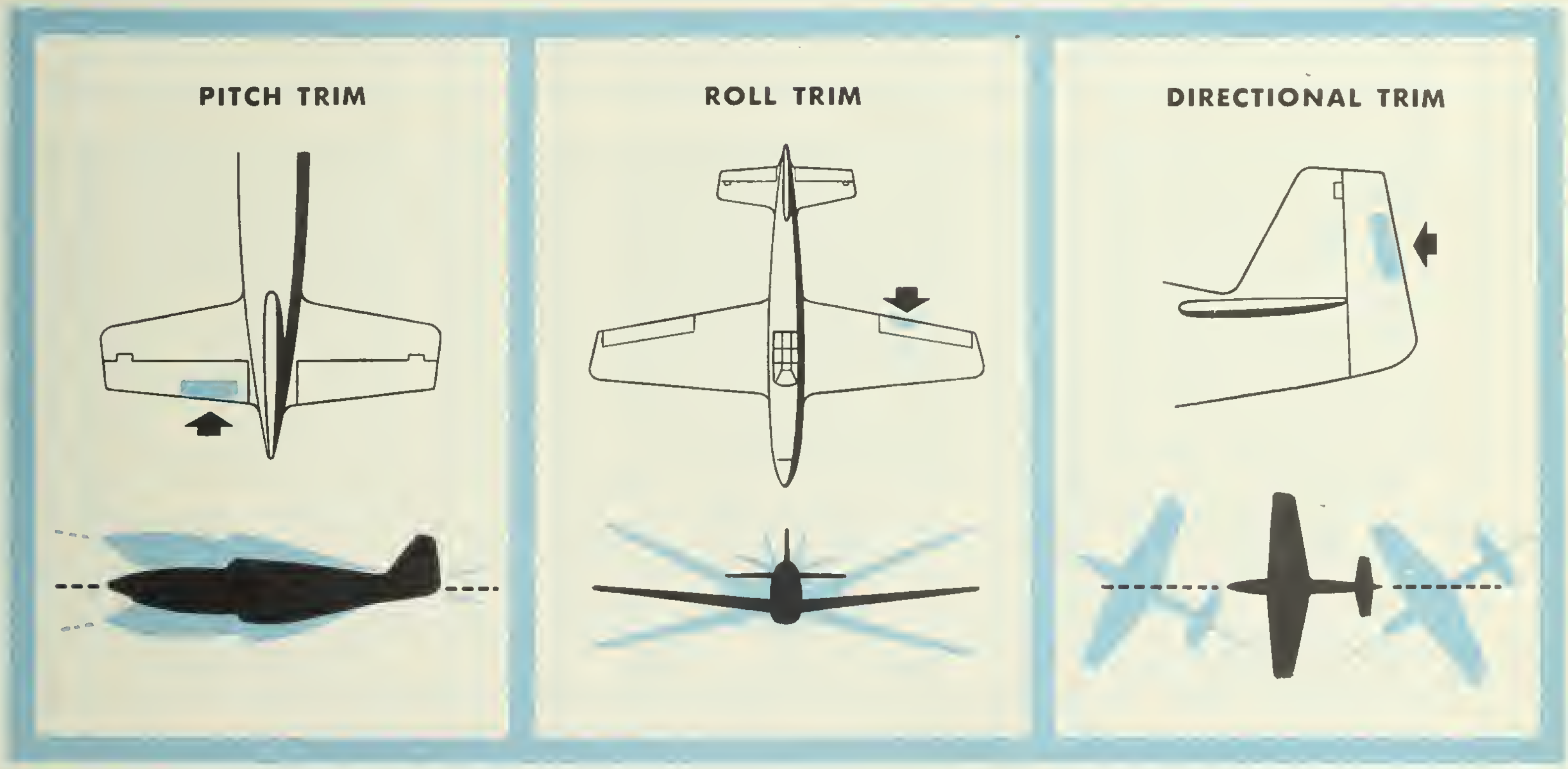
Tips

In heavy airplanes, to get the plane on its most efficient aerodynamic step, trim with the nose slightly down.

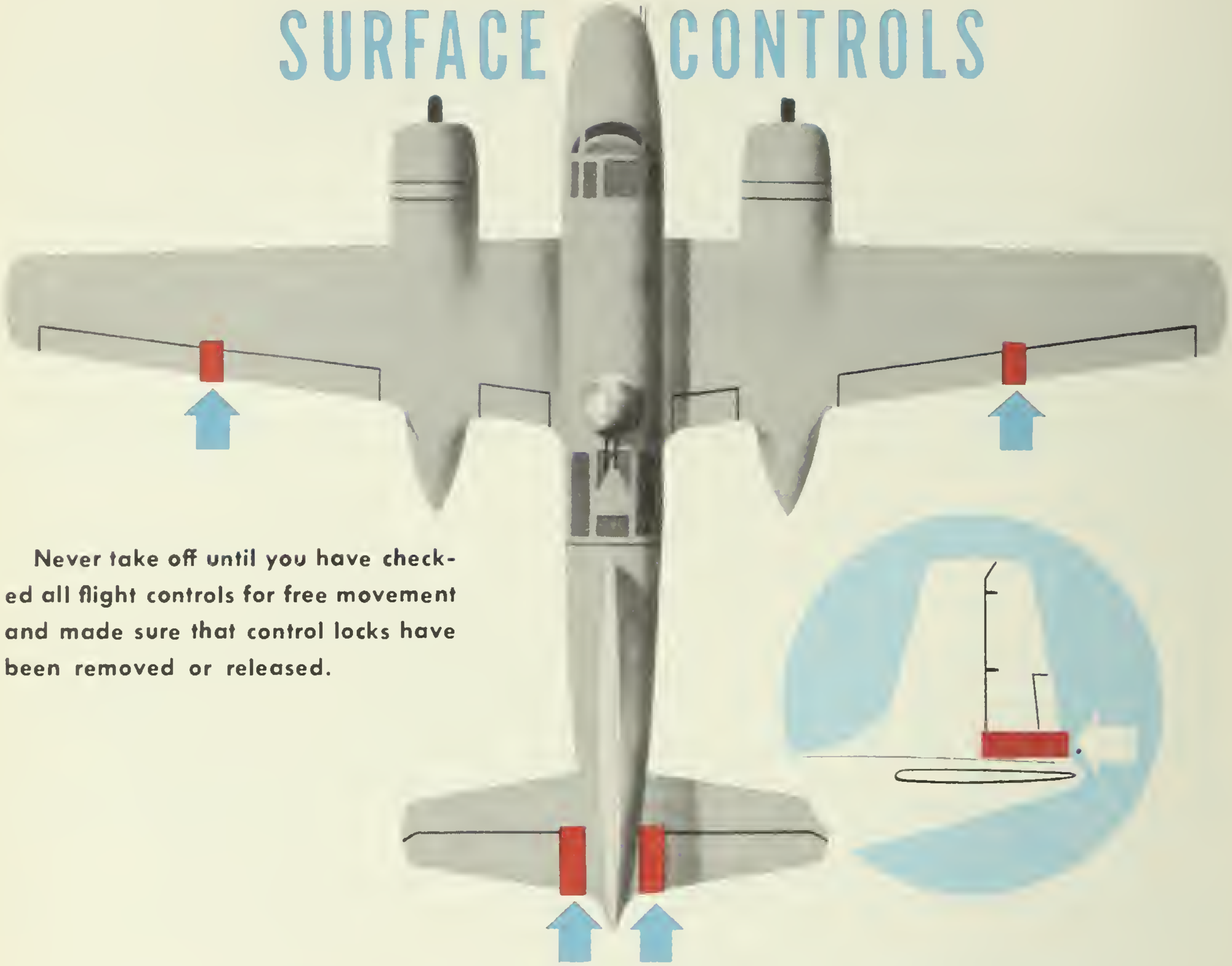
Always wait until the airplane has attained cruising speed at the desired altitude before final trimming for hands-off flight. Ordinarily you climb a little above desired cruising altitude and begin the trim as you descend to that altitude.

Correct the elevator trim setting quickly on any attempted landing that goes wrong before you apply full throttle for a go-around.

Don't forget to check trim in relation to shifting fuel loads.



SURFACE CONTROLS



Never take off until you have checked all flight controls for free movement and made sure that control locks have been removed or released.

On aircraft having internal surface control locks, engage the locking devices whenever there will be no one at the controls. Be sure to install external surface locks on an airplane requiring them before you leave the plane unattended. This precaution is necessary whether or not there is high wind.

High winds and propeller blasts from other airplanes may cause serious damage to surface controls, even when you are taxiing, waiting for takeoff, or parking. If the control surfaces are moved violently against their stops or to the limit of travel during such maneuvers, have a special preflight inspection made before flying the airplane again.

Surface Control Positions

During a ground check or when taxiing do not run up engines with the surface controls in a locked position. This imposes undue strains on the control surface structures. Hold elevators on nosewheel aircraft in the neutral position at such times. If your airplane has a tailwheel be sure to hold the elevator in a position to prevent nose-overs when running up engines at high speeds.

Inspections

Make frequent inspections of control surfaces including hinges, hinge brackets, control horns, and attachment of surfaces to torque tubes. Check to see that rivets have not been sheared or loosened, particularly if gusty or violent wind conditions have occurred in the vicinity of the airplane.

Important

When operating internal locks always be sure the locking device has actually engaged the controls when you want them locked and has actually disengaged them before takeoff.

CARE OF THE AIRPLANE

Ordinarily you have a competent and efficient crew to care for your airplane on the ground. The crew, however, will take a greater interest in their job if they know your interest in the plane doesn't stop the minute you cut the switches. There will be times, also, when you land at fields with limited servicing facilities, or in combat areas, where it will pay you well to know something about ground maintainance.

Cleaning the Plane

See that the ground crew keeps the exterior surface of the airplane clean. Have them remove oil and dirt accumulations frequently. Keep the cockpit clean. If near the sea make sure that spray and salt deposits are washed off quickly to prevent corrosion.

Towing

Caution the crew always to use the proper towing bars, towing rings, or similar devices. If other methods of towing are used lines should be attached in such a way that they will not damage the fairing or other parts of the airplane. The length of a tow rope should be at least three and a half times the length of the tread of the airplane, particularly when towing over soft ground.

When a tow bar is attached to a nosewheel, be sure the tow bar pin is in place and locked and that the nosewheel snubber is unlocked.

Lifting Tail Section

Never allow a tailwheel airplane to be lifted at the empennage except at the specified points. Indiscriminate lifting may cause considerable damage to the underside of horizontal stabilizers.

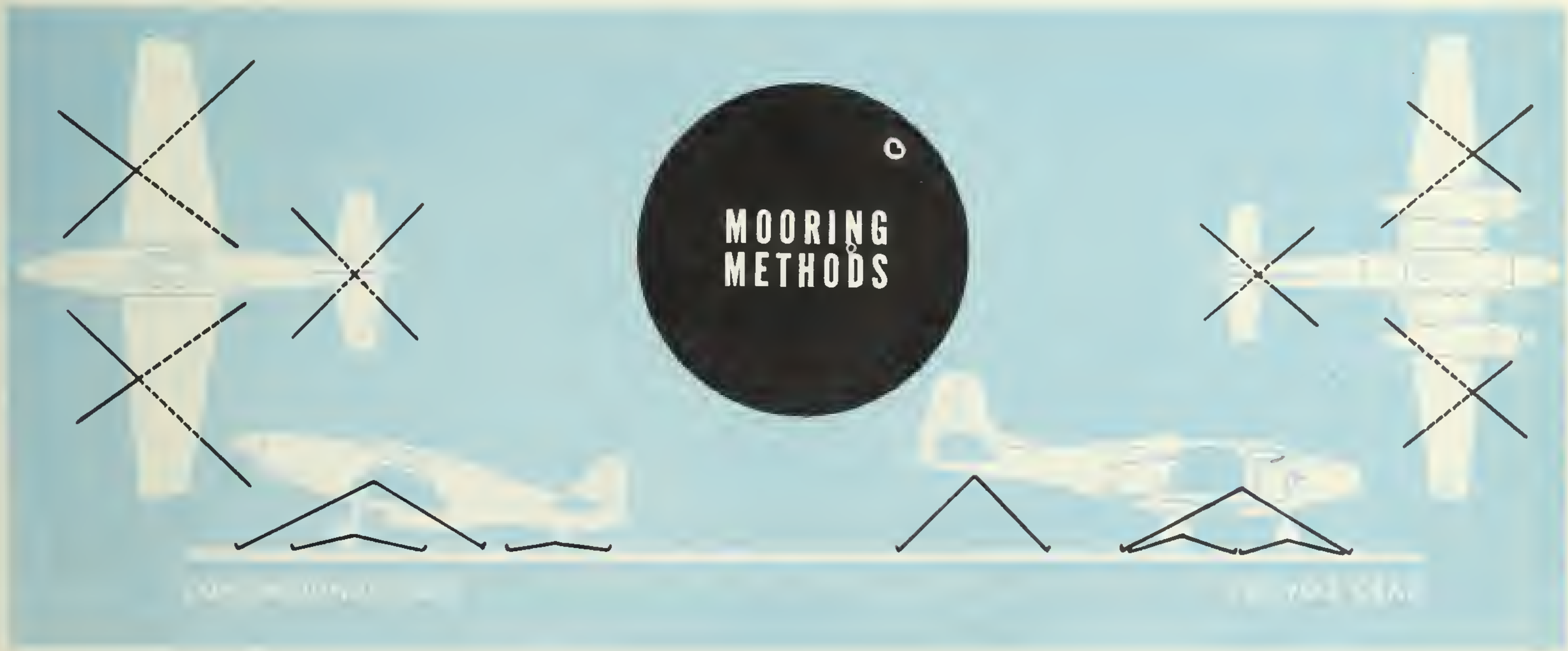
Mooring

It may be necessary for you to moor your own plane some day. Talk over this possibility with your crew chief and get him to show you how to handle your particular model. Details of mooring procedures for various types of aircraft and descriptions of the three standard mooring kits are contained in T.O. 01-1-50. Also learn how to construct a dead-man mooring should standard mooring equipment not be available.

Plexiglas

Keep plexiglas surfaces clean at all times, using plenty of pure water. The bare hand is the best wiper since cloths often contain grit which may scratch plastic. Avoid strong soaps or solvents.

In sandy or windy regions cover plexiglas to prevent scratches. In hot climates cover it with canvas so that the sun will not soften and bend it.



EMERGENCY EXITS

All AAF airplanes provide means of quick exit in the air, on the ground, or in water. From the pilot's and crew's standpoint, however, the use of many of these exits requires certain special techniques which cannot be covered by general escape instructions.

Size of Hatches

If the top ditching hatch on your airplane measures less than 18 inches in diameter or 18 inches square, you must give special attention to clothing and other personal equipment so that you can be sure of clearing the opening. Give the same careful consideration to side hatches measuring less than 20 by 31 inches and belly hatches measuring less than 20 by 29 inches.

Belly-Hatch Bailouts

There are two approved methods of clearing the airplane from the belly hatch. When possible, kneel on the rear edge of the hatch, face forward, and roll out headfirst. If there is insufficient room behind the hatch, sit down on the front edge, place your hands on the rear edge and pivot through feet first, with arms rigid to prevent your head from striking the rear edge as you drop.

Preparation

The most important requirement for bailing out is thorough and intelligent ground training of the entire crew. Don't assume that a crew member knows how to use a hatch simply because you have told him about it or because he has looked at it once. First, assume that any crew member may have to use any hatch in the plane. Second, if no mock-up is available, even if it takes a little time to replace the hatches, make every man, wearing full air equipment, practice the entire bailout procedure. Have them actually bail out into a tarp or the arms of the other crew members on the ground. This helps train your men not to have extra equipment lying in their paths to the hatches. It teaches them also which hatches they can or cannot use when wearing full equipment. Third, it serves as a good check on the maintenance of the emergency release mechanisms.

Choice of Hatches

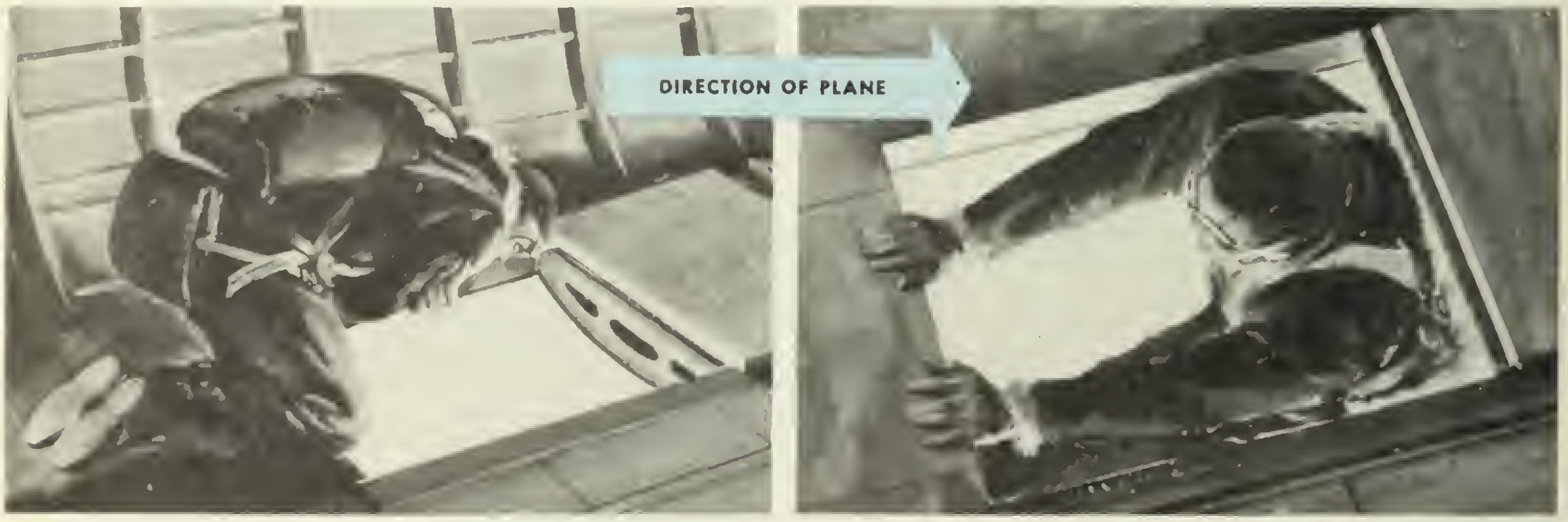
If several hatches are available, establish a set of choices for each crew member. **The last choice** always should be any hatches on top of the plane. They are the most dangerous because of the possibility of being hit by a propeller or striking the tail.

General

On ground or water fasten all lower hatches before landing. Dump all upper hatches; they may jam upon impact and delay escape. If your airplane has a hand axe know its location, so that you can cut through the airplane skin if necessary.

After you have pulled emergency release handles you usually can dump the door or hatch with a slight push. When dumping upper hatches, remember they may damage the tail assembly.

Hold practice drills before flight. Each man should know his exact duties and any emergency signals he may receive.



The two approved methods of clearing the belly hatch.

Safety Belts

Fasten your seat belt on entering the plane and be sure that belts of all passengers are properly secured. The safety belt has two purposes:

1. To keep you in the airplane.
2. To protect you in case of a crash.

Keep belts fastened at all times except when duties require free movement about the plane. Replace the belt at once upon resuming seat.

Before acrobatics, check your belt and **see that the belt is tight.** The catch may have loosened. Always check with your passenger just before performing acrobatics. He may have a loose belt or a loose catch.

Always put belt over, not through, parachute harness. You may want to bail out.

Don't wear a twisted safety belt. It cuts.

Safety Shoulder Harness

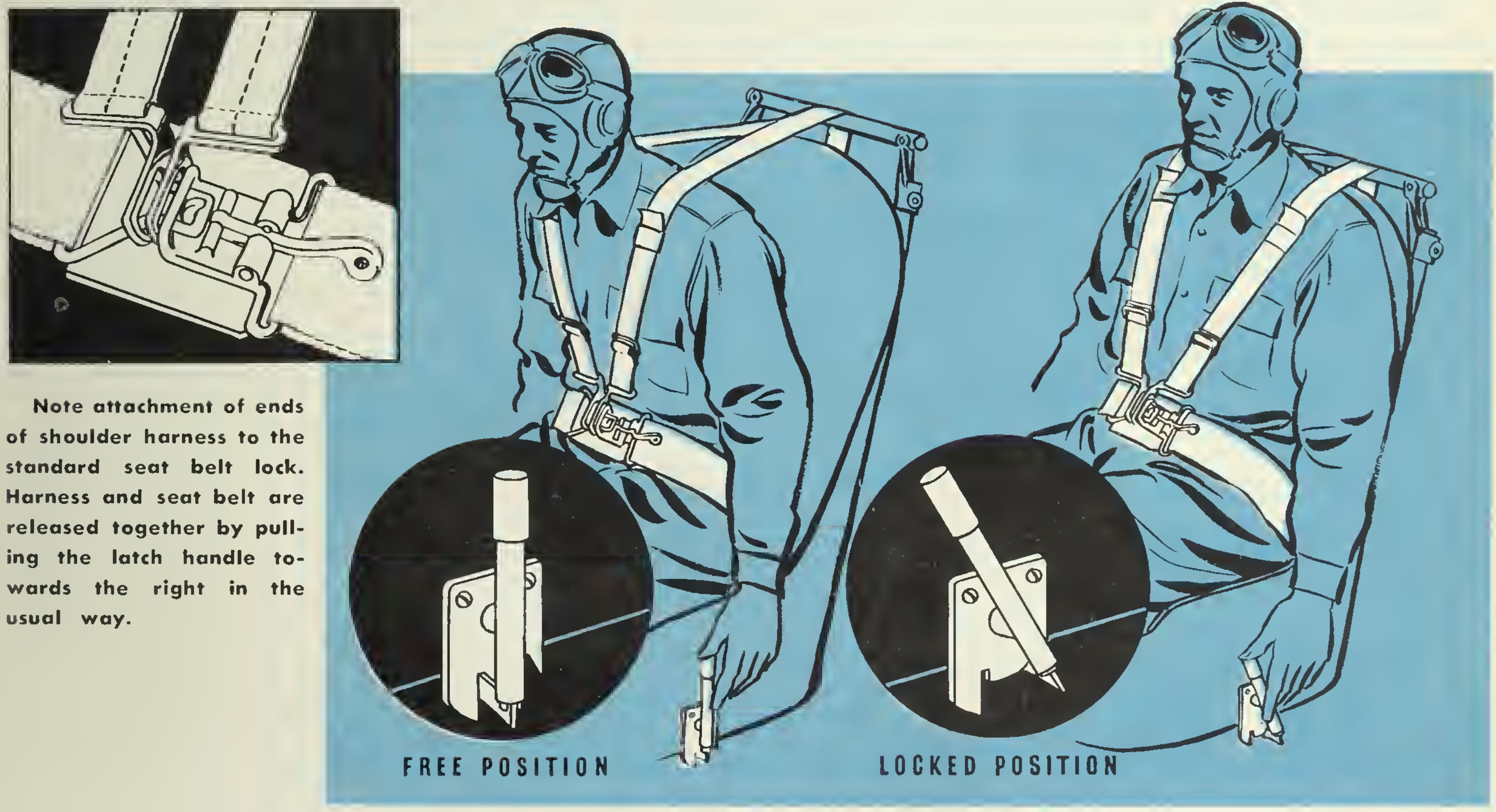
Always wear the safety shoulder harness when it is available.

It can be adjusted in two ways: to give freedom of movement (unlocked), or to prevent the wearer from being thrown forward on crash impact (locked). **Have it locked during all take-offs and landings (crash or otherwise), and in acrobatics.** Upon crash impact the shoulder straps prevent your head and chest from being thrown forward against the cowling, instrument panel, or gunsight. Experienced pilots and medical officers are convinced that a properly used shoulder harness has prevented many serious injuries and saved many lives. The shoulder harness will not break your neck.

To adjust, be sure straps are over crossbar at the top of seat where a crossbar is installed. Insert metal ends into tongue of seat belt lock. Pulling the latch handle to the right in the usual way releases both belt and harness.

Harness is locked by adjusting lever at left of seat base. When lever is upright (or to rear), harness is unlocked and allows you to lean forward. Pressing down on the top of the lever and shifting it forward sets a catch which allows the harness to lock when the wearer leans back against the seat. **To adjust the harness for fit, wear your parachute and adjust the straps to fit snugly in the locked position.** Otherwise the straps may be too short to allow the lock to catch when you lean back.

REFERENCE: Technical Order 03-1-2, AAF Regulation 62-18.



Note attachment of ends of shoulder harness to the standard seat belt lock. Harness and seat belt are released together by pulling the latch handle towards the right in the usual way.

Safety Precautions

LOOSE EQUIPMENT

Loose equipment or accessories, carelessly stowed in your airplane, may create a serious hazard to safe flight.

They may jam the controls.

They may cause injury by shifting during violent maneuvers or forced landings.

There's a place for everything in your plane:

Replace accessories where they belong and be sure that they are fastened securely.

Tape the extra length of microphone wire to a convenient part of the airplane so that it cannot jam the controls in case the microphone is dropped.

Secure oxygen equipment when not in use. Don't drop it in the plane.

Keep the front cockpit free of loose equipment; store all cargo, tools, baggage, and other loose articles so that they will not shift in flight.

BOMB BAY DOORS

On the ground. Don't open or close bomb bay doors blindly. Have a man on watch signal "Clear".

Close bomb bay doors before starting engines on the ground unless you desire to blow gasoline fumes from the bomb bay.

In flight. Bombardier must get pilot's permission before opening bomb bay doors. Notify radio operator to reel in antenna before opening doors.

After takeoff from a muddy or slushy field in cold weather, operate bomb bay doors through several cycles to prevent freezing.

Doors open automatically when salvoing bombs.

Don't drop bombs in the normal manner unless you know the bomb bay doors are open.

Know exactly how long it takes to open doors, salvo bombs, and close doors.

Know how long emergency means will keep the bomb bay doors open to allow escape.

Don't crash land with bomb bay doors open.

Study emergency methods of bomb release, learn how to use each, and know whether the bombs will be armed or safe.

SAFETY HINTS

Many practices that are relatively harmless in trainers are hazardous in higher speed airplanes.

Don't extend hands or arms—or anything—out of windows or above the canopy.

Never attach streamers or other objects to any flight or control surfaces, for identification.

Have all control surfaces, trim tabs and hinges clean of mud, waste or ravelings of cleaning cloths or mooring lines. They may affect seriously the flight characteristics of the airplane.

Close cockpit windows tightly; otherwise they may throw the airplane out of trim.

Use particular care in takeoffs and landings on sandy or gravelly fields. Scratches or dents made by gravel or weeds may injure control surfaces, air foils, or propellers.

Don't attempt to lower flaps or landing gear at high speeds.

WEIGHT AND BALANCE

NOTICE

AAF Regulation 55-3 directs that "No pilot will accept and operate any aircraft without satisfactory evidence of correct gross weight and balance. This is a matter of safety of personnel and equipment and will be strictly enforced."

There are two things a pilot must know about the weight and balance of any airplane he is going to fly.

1. The gross weight.
2. The location of the center of gravity (CG).

High Gross Weight

Loading above recommended maximum gross weight results in a high gross weight condition.

Every model of aircraft is designed to do certain work efficiently. Among other things it is built to fly within specified load limits. The upper limit is figured with a factor of safety great enough to allow for the stresses and strains of all ordinary operations and permitted maneuvers.

If, however, you try to fly an airplane with a greater load than it was designed to carry, you decrease its range, you increase its stalling speed, you require more runway to take off and land. If you lose an engine in multi-engine equipment, these loads are particularly hazardous.

At high gross weight, an airplane may suffer structural damage in turbulence or under rough handling.

With any high gross weight you have a reduced factor of safety. If you get into trouble, you may not have enough margin.

The term "overload" commonly used for the above condition actually means unflyable gross weight.

Unbalanced Load

The effect of balance on an airplane's performance may be even more critical than the effect of overload. If you take off with an airplane even slightly out of balance (with the CG outside the allowable limits), you have difficulty with your control; it changes the spin and stall characteristics of your plane, it handles badly in turbulence, and puts undue strains on the pilot.

An airplane badly out of balance is erratic to the point of uncontrollability. If you get into trouble in the air, you may not be able to recover—especially from a spin. A tail-heavy spin is usually a flat or erratic spin.

There is less danger from a nose-heavy unbalanced condition; but you'll have your hands full landing an airplane that is excessively nose-heavy.

Pilot Responsibility

Since you are responsible for knowing the gross weight and balance condition of any airplane you fly, you must understand the simple basic principles upon which load conditions are figured. You do not have to do it all, your Weight and Balance Officer is charged with many of the duties; but you must know enough to check his work. Your signature on Form F certifies that the airplane is loaded as shown.

Gross Weight

Gross Weight is figured by knowing the basic weight, and adding to it the disposable weight for any particular mission.

Basic Weight is the weight of the airplane with its modifications and the operational equipment that stays in the plane. This information is supplied to you in airplanes requiring it. (Certain airplanes in Class 1 are exempt from these requirements. Check with your Weight and Balance Officer.)

Disposable Weight is everything else in the airplane — the crew and their equipment, fuel, oil, ammunition, cargo, etc. Anything that is not permanently (or semi-permanently) in the airplane.

When you have figured your disposable weight and added it to the basic weight of plane, the total must not exceed allowable gross weight for takeoff.

Landing Gross Weight

Remember that for bombers and cargo aircraft there is also an allowable **landing gross weight.** Be sure that you will be at or under allowable landing weight before your first landing.

Determining the Balance

With the gross weight figured within the allowable limits, you must next be sure that the load is properly distributed in your plane.

The Center of Gravity (CG) of an airplane and its load is that point at which, if suspended, the airplane would balance itself. Airplanes are so designed that you can fly them safely if the actual CG varies several inches fore or aft.

The performance of the plane within these limits is fully satisfactory. Flight tests have proved that cruising speed, climbing, and other normal operations are so slightly affected within the allowable CG range, that there is no need to spend the time and effort required to load an airplane to an exact CG point. **But it must fall within CG limits.**

The principle of figuring the CG of an airplane is the same as the principle of the steel-yard scale or the see-saw. Weight near the CG has less effect than weight farther from the CG.

Weight multiplied by its distance from a CG point equals **moment.** The sum of all the moments on one side of the CG equals the sum of all the moments on the other side of the CG.

There are various aids provided to simplify the process of figuring the load condition of your plane:

The **Load Adjuster,** found in most Class 2 airplanes, is comparatively simple to operate. You will find full directions in the data case, or ask the Weight and Balance Officer to instruct you in its use.

Loading Graphs (Chart E) supplied in some airplanes not equipped with load adjusters. By following directions carefully you can determine the CG condition with the graph.

Weight and Balance in Flight

Both the Gross Weight and the CG condition of your airplane change in flight as you:

1. Use up fuel and oil.
2. Drop bombs and expend ammunition.
3. Fly into icing conditions.

Figure before takeoff on the normal changes expected in flight and provide for keeping the load in balance.

Know where your crew and passengers are all the time. This is important. Don't let them shift about the airplane or move heavy cargo without reporting change of positions to you.

If you know the disposition of load, passengers, and crew, you can figure quickly the proper moves necessary to keep your CG condition within safe limits at all times.

Forms

The "Weight and Balance Data" book (AN 01-1B-40) is in the data case of the airplane. Below are listed the forms you will find in the book and your responsibility for them:

Airplane Weighing Form. You are not responsible for it, but check it. The airplane should be reweighed:

1. After major modification or repair.
2. If you find its balance condition unsatisfactory during flight.
3. If you suspect error in the basic data.

Chart A lists operational items and their location in the plane. From time to time such items are moved, taken out, or others put in. See that it is up-to-date.

Chart C, the basic weight and balance record, gives the latest basic weight, moment, and CG index. From this chart you get the figures for basic weight entry on Form F.

FORM F

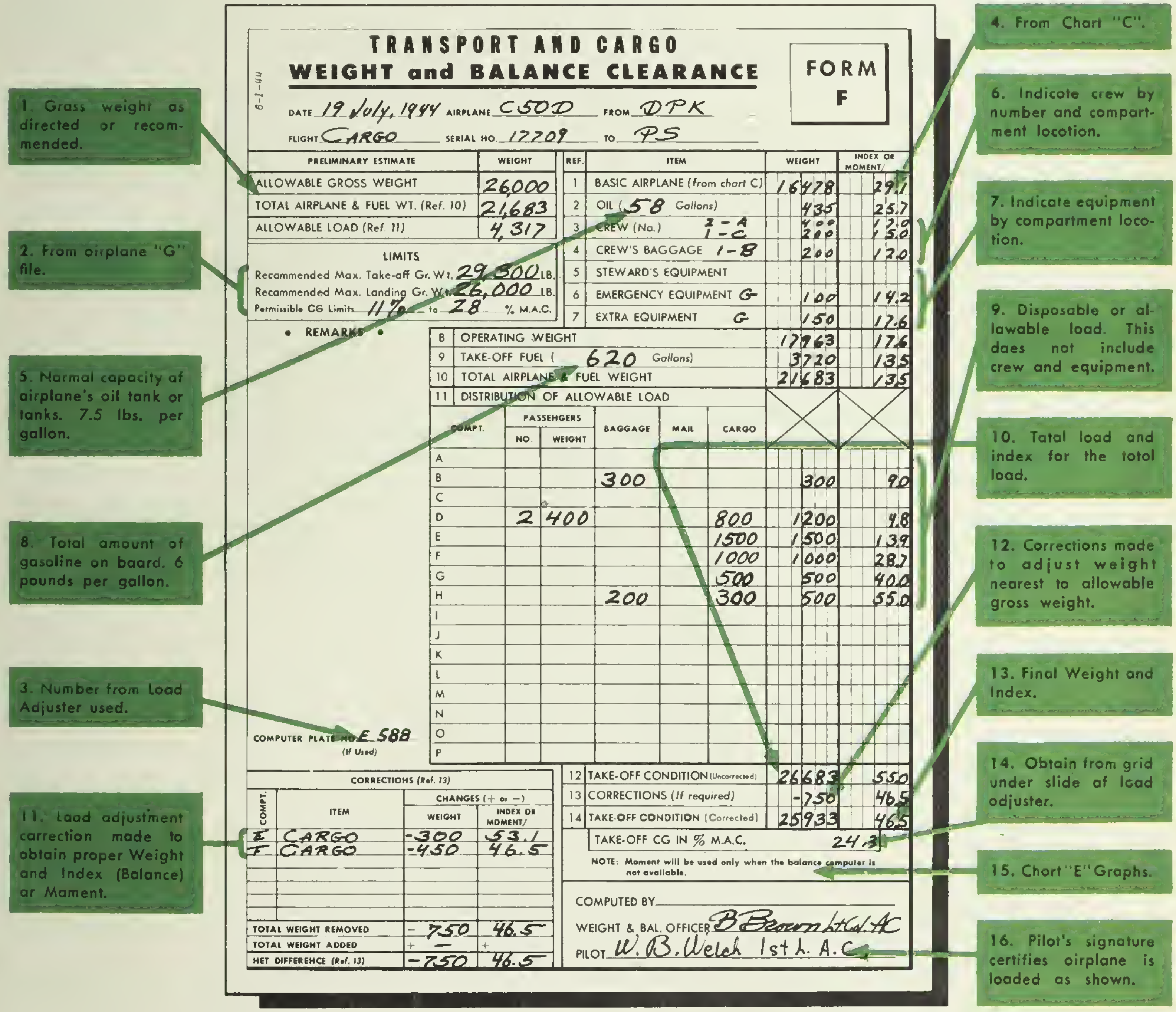
Lists weight, location, and index of all disposable or transient weight on Class 2 airplanes. Use with load adjuster or Chart E (Loading Graph). One chart for Transport and Cargo Types, one for Tactical Types. The person who supervises the loading is responsible for filling out the Form F. You are responsible for seeing that it's correct when complete.

Attach to Form 23 when you file your flight plan.

You need not file a Form F on a Class 2 airplane:

1. When load is identical with one on which a Form F has been filed previously (check duplicates in Handbook of Weight and Balance Data).
2. If you land en route, take on fuel, and other disposable or transient weights remain the same.

In either case, certify that a Form F was filed previously, giving date and place.



8-1-44

TRANSPORT AND CARGO
WEIGHT and BALANCE CLEARANCE

FORM F

DATE 19 July, 1944 AIRPLANE C50D FROM DPK
FLIGHT CARGO SERIAL NO. 17709 TO PS

PRELIMINARY ESTIMATE	WEIGHT
ALLOWABLE GROSS WEIGHT	26,000
TOTAL AIRPLANE & FUEL WT. (Ref. 10)	21,683
ALLOWABLE LOAD (Ref. 11)	4,317

LIMITS
Recommended Max. Take-off Gr. Wt. 29,300 LB.
Recommended Max. Landing Gr. Wt. 26,000 LB.
Permissible CG Limits 11% to 28 % M.A.C.

• REMARKS •

REF.	ITEM	WEIGHT	INDEX OR MOMENT/
1	BASIC AIRPLANE (from chart C)	16478	29.1
2	OIL (58 Gallons)	435	25.7
3	CREW (No.) 2-A 1-C	400 200	12.0 15.0
4	CREW'S BAGGAGE 1-B	200	12.0
5	STEWARD'S EQUIPMENT		
6	EMERGENCY EQUIPMENT G	100	14.2
7	EXTRA EQUIPMENT G	150	17.6
8	OPERATING WEIGHT	17763	17.6
9	TAKE-OFF FUEL (620 Gallons)	3720	13.5
10	TOTAL AIRPLANE & FUEL WEIGHT	21683	13.5
11	DISTRIBUTION OF ALLOWABLE LOAD		

COMPT.	PASSENGERS		BAGGAGE	MAIL	CARGO		
	NO.	WEIGHT					
A							
B			300			300	9.0
C							
D	2	400			800	1200	4.8
E					1500	1500	13.9
F					1000	1000	28.7
G					500	500	40.0
H			200		300	500	55.0
I							
J							
K							
L							
M							
N							
O							
P							

COMPUTER PLATE NO. E 588
(If Used)

12	TAKE-OFF CONDITION (Uncorrected)	26683	55.0
13	CORRECTIONS (If required)	-750	46.5
14	TAKE-OFF CONDITION (Corrected)	25933	46.5

TAKE-OFF CG IN % M.A.C. 24.3

NOTE: Moment will be used only when the balance computer is not available.

CORRECTIONS (Ref. 13)

COMPT.	ITEM	CHANGES (+ or −) WEIGHT	INDEX OR MOMENT/
E	CARGO	-300	53.1
F	CARGO	-450	46.5
TOTAL WEIGHT REMOVED		− 750	46.5
TOTAL WEIGHT ADDED		+ —	+
NET DIFFERENCE (Ref. 13)		−750	46.5

COMPUTED BY
WEIGHT & BAL. OFFICER B Brown Lt Col. AC
PILOT W. B. Welch 1st L. A.C.

1. Gross weight as directed or recommended.

2. From airplane "G" file.

3. Number from Load Adjuster used.

4. From Chart "C".

5. Normal capacity of airplane's oil tank or tanks. 7.5 lbs. per gallon.

6. Indicate crew by number and compartment location.

7. Indicate equipment by compartment location.

8. Total amount of gasoline on board. 6 pounds per gallon.

9. Disposable or allowable load. This does not include crew and equipment.

10. Total load and index for the total load.

11. Load adjustment correction made to obtain proper Weight and Index (Balance) or Moment.

12. Corrections made to adjust weight nearest to allowable gross weight.

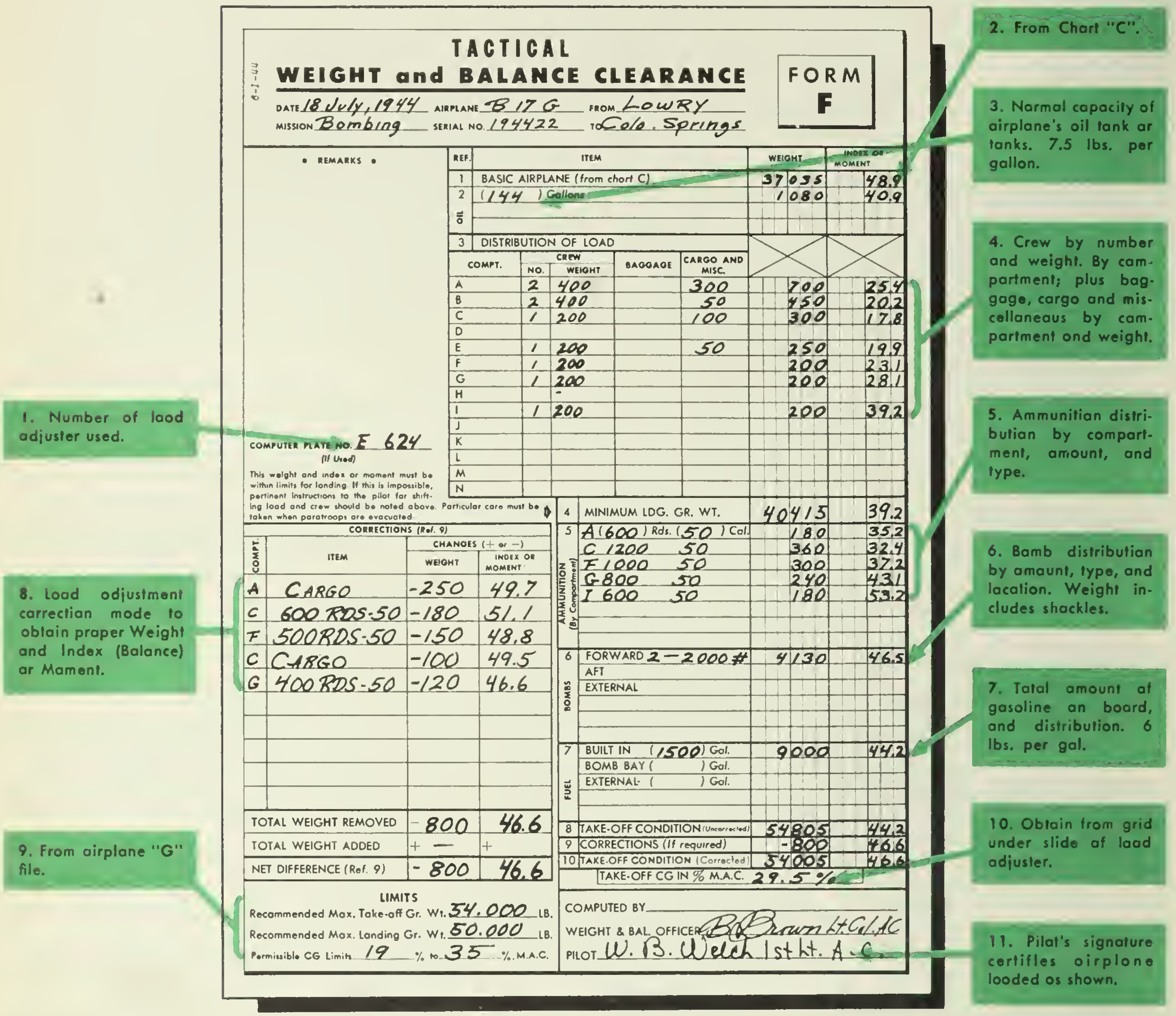
13. Final Weight and Index.

14. Obtain from grid under slide of load adjuster.

15. Chart "E" Graphs.

16. Pilot's signature certifies airplane is loaded as shown.

TURN PAGE TO SEE SPECIMEN FORM F FOR TACTICAL AIRPLANES ➧



6-1-44

TACTICAL
WEIGHT and BALANCE CLEARANCE

FORM
F

DATE 18 July, 1944 AIRPLANE B 17 G FROM LOWRY
MISSION Bombing SERIAL NO. 194422 TO Colo. Springs

• REMARKS •

REF.	ITEM	WEIGHT	INDEX OR MOMENT
1	BASIC AIRPLANE (from chart C)	37035	48.9
2	(144) Gallons	1080	40.9
OIL			
3	DISTRIBUTION OF LOAD		

COMPT.	CREW NO.	CREW WEIGHT	BAGGAGE	CARGO AND MISC.	WEIGHT	INDEX OR MOMENT
A	2	400		300	700	25.4
B	2	400		50	450	20.2
C	1	200		100	300	17.8
D						
E	1	200		50	250	19.9
F	1	200			200	23.1
G	1	200			200	28.1
H		-				
I	1	200			200	39.2
J						
K						
L						
M						
N						

COMPUTER PLATE NO. E 624
(If Used)

This weight and index or moment must be within limits for landing. If this is impossible, pertinent instructions to the pilot for shifting load and crew should be noted above. Particular care must be taken when paratroops are evacuated.

REF.		ITEM	WEIGHT	INDEX OR MOMENT
4		MINIMUM LDG. GR. WT.	40415	39.2
5	AMMUNITION (By Compartment)	A (600) Rds. (50) Cal.	180	35.2
		C 1200 50	360	32.4
		F 1000 50	300	37.2
		G 800 50	240	43.1
		I 600 50	180	53.2
6	BOMBS	FORWARD 2—2000#	4130	46.5
		AFT		
		EXTERNAL		
7	FUEL	BUILT IN (1500) Gal.	9000	44.2
		BOMB BAY ( ) Gal.		
		EXTERNAL ( ) Gal.		
8		TAKE-OFF CONDITION (Uncorrected)	54805	44.2
9		CORRECTIONS (If required)	-800	46.6
10		TAKE-OFF CONDITION (Corrected)	54005	46.6

TAKE-OFF CG IN % M.A.C. 29.5 %

CORRECTIONS (Ref. 9)

COMPT.	ITEM	CHANGES (+ or —) WEIGHT	INDEX OR MOMENT
A	CARGO	-250	49.7
C	600 RDS-50	-180	51.1
F	500RDS-50	-150	48.8
C	CARGO	-100	49.5
G	400 RDS-50	-120	46.6
TOTAL WEIGHT REMOVED		- 800	46.6
TOTAL WEIGHT ADDED		+ —	+
NET DIFFERENCE (Ref. 9)		- 800	46.6

LIMITS
Recommended Max. Take-off Gr. Wt. 54,000 LB.
Recommended Max. Landing Gr. Wt. 50,000 LB.
Permissible CG Limits 19 % to 35 %. M.A.C.

COMPUTED BY
WEIGHT & BAL. OFFICER B. Brown Lt. Col. AC
PILOT W. B. Welch 1st Lt. A. C.

1. Number of load adjuster used.

2. From Chart "C".

3. Normal capacity of airplane's oil tank or tanks. 7.5 lbs. per gallon.

4. Crew by number and weight. By compartment; plus baggage, cargo and miscellaneous by compartment and weight.

5. Ammunition distribution by compartment, amount, and type.

6. Bomb distribution by amount, type, and location. Weight includes shackles.

7. Total amount of gasoline on board, and distribution. 6 lbs. per gal.

8. Load adjustment correction made to obtain proper Weight and Index (Balance) or Moment.

9. From airplane "G" file.

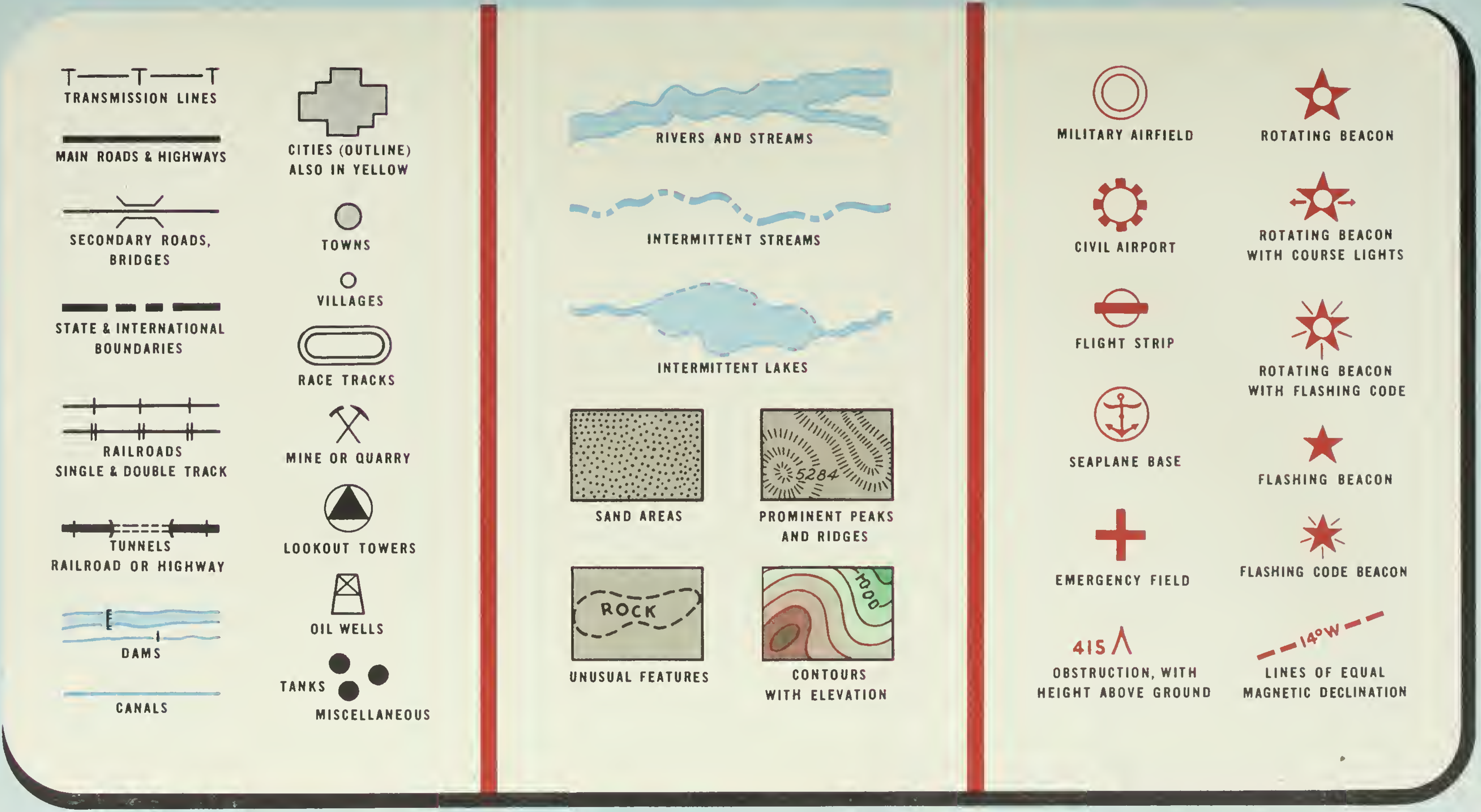
10. Obtain from grid under slide of load adjuster.

11. Pilot's signature certifies airplane loaded as shown.

RULE-OF-THUMB FIGURES FOR DISPOSABLE ITEMS:

Each crew member or passenger (with parachute)	200 lbs.
Fuel, per gallon	6 lbs.
Oil, per gallon	7.5 lbs.
.30 cal. ammunition, 100 rounds	6.5 lbs.
.50 cal. ammunition, 100 rounds	30.5 lbs.
.20 mm ammunition, 100 rounds	55 lbs.

Aeronautical Chart Symbols



SECTION 7 NAVIGATION AIDS

EVERY pilot knows basic navigation. This section, therefore, is not designed to teach you pilot navigation nor instrument flying techniques. It contains information and tips on pilotage, dead reckoning, and the use of radio to aid you on all flights.

The types of navigation you use on most flights are not difficult to master if you plan your flights carefully before takeoff. Practice using all forms of navigation. Don't depend on one method.

Remember, you have little time for additional planning and figuring in the air. Your ability to plan your flight correctly—and to follow the plan through to the end—should become as natural as flying itself.

FLIGHT PREPARATION

BEFORE YOU TAKE OFF

Careful flight planning simplifies your navigation problems. This is a good check list:

Get proper charts covering flight and number in the order you'll use them.

Check NOTAMS. Note changes on charts.

Draw course line. Note elevations of highest points along and near your route. Pick a safe altitude.

Plan the legs of your flight. Plan to make all turns over check points when possible.

Note location, frequency, and call letters of all radio ranges along your course.

Mark course line in 20-mile increments to help you check distance travelled. They may not fall on check points.

Mark all check points plainly and boldly.

Note distance between check points.

Make a log of check points on a sheet of paper indicating the distance between them.

Get all necessary weather information.

Study winds-aloft charts carefully. Get a winds-aloft forecast.

Figure wind drift for each leg of your flight.

Compute true airspeed and probable groundspeed.

Compute time between check points.

Add information to log.

Figure total elapsed time to destination.

Compute fuel consumption and range.

Note and check all emergency landing strips on each side of your course.

Check compass and radio before takeoff.

Each base operations office has on file all the navigational information you require for any flight. There need be no question marks on your course if you know where to look for this data.

Use it in connection with complete and current weather information. The following guide will tell you where to look for what you need. Make good use of the USAAF Airport Directory, Continental U. S.; it contains much excellent information, including photographs of landing fields.

	DATA	WHERE TO FIND IT
AIRPORT FACILITIES	Runways information Weather station facilities Type of operations Radio facilities and hours of operation Closed or open to army transients? Servicing (repairs & fueling) Distance of airfields from adjacent towns Obstructions and markings Field elevations	USAAF Airport Directory, Continental U.S. Less detailed data on most items also found in Army-Navy Directory of Airfields
RADIO NAVIGATIONAL FACILITIES	Radio range frequencies and call letters Tower frequencies and call letters Distance between range stations	Radio Facility Charts T. O. 08-15-1
	Instrument let-down procedures	T. O. 08-15-3
	Complete detailed information on let-down procedures, obstructions, and location of buildings	Instrument Approach and Landing Charts
	Commercial broadcasting stations	T. O. 08-15-2
EMERGENCY LANDING FIELDS		Regional Aeronautical Charts
NAVIGATIONAL HAZARDS	Danger and caution areas Changed lighting facilities No servicing facilities Closed fields Fields under construction No lighting facilities	Weekly Notices to Airmen (use in conjunction with Notams)

CHECK WEEKLY NOTICES TO AIRMEN AND NOTAMS FOR LATEST GENERAL FLIGHT AND FIELD INFORMATION

IAS to TAS

Before takeoff get temperature at cruising altitude from adiabatic charts in weather office. Then correct IAS for temperature and altitude.

If you have no computer, consult the table on PIF 2-19-2 which converts IAS to approximate true airspeed at various altitudes.

Log

Keep a log of your flight. Write down pertinent information to use during your flight. Never trust your memory.

AERONAUTICAL CHARTS

Charts are maps which contain navigational data. You need them on every flight you make, contact or instrument.

Be familiar with all the information on the charts.

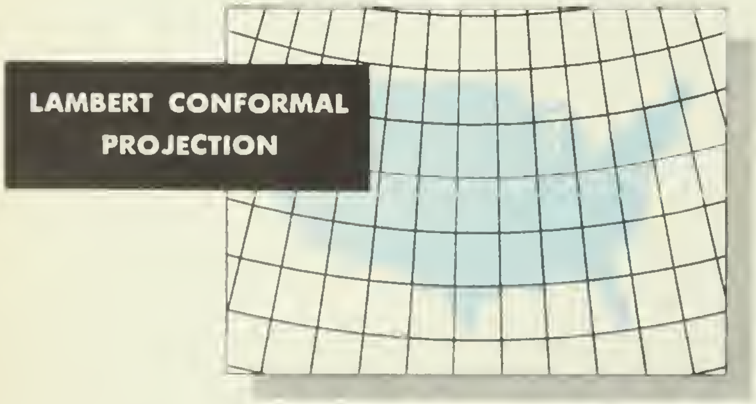
Learn the meaning of the symbols on aeronautical charts so you won't have to refer to the legend.

Plan your flight carefully before takeoff.

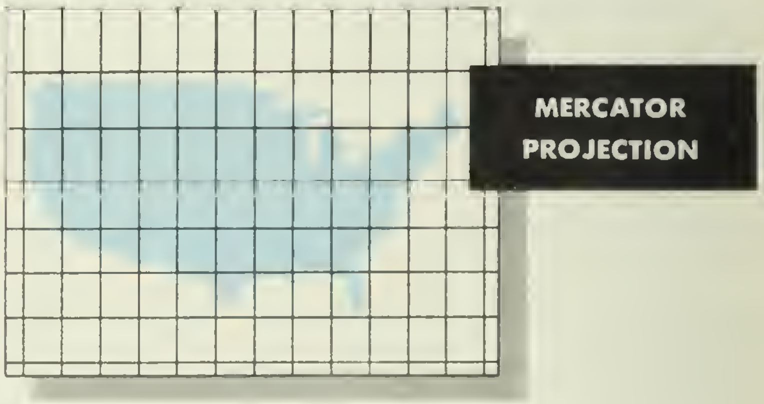
Then use the charts when you're in flight.

Lambert Conformal and Mercator Projections

Most aeronautical charts used in the AAF are Lambert Conformal Projections. This type of chart represents a portion of the surface of the earth as a section of a cone, laid out flat. The cone intersects the surface of the earth along two lines, called Standard Parallels, which are parallel to the lines of latitude. The area between the Standard Parallels,



LAMBERT CONFORMAL PROJECTION



MERCATOR PROJECTION

indicated on the upper right-hand corner of the chart, has almost no distortion; meridians converge toward the nearest pole.

Lambert Conformal projections closely resemble a portion of the globe as you see it. There is little distortion; land and water areas are shown in their correct proportion. A straight line drawn between two points on the chart represents approximately the shortest distance between those points. The graphic scale along the margin is an average for the chart. Use it for scaling distances.

You use Lambert Conformal projections on most flights.

Mercator Projections show all meridians as parallel lines and all lines of latitude perpendicular to the meridians as parallel lines. There is considerable distortion on all parts of these charts except at the Equator. They may be issued to you in some combat theatres, **so know which projection you have, before you start flight preparations.**

Types of Lambert Conformal Charts

Sectional Aeronautical Charts: Scale, 8 miles to the inch (1:500,000). 87 charts cover the U.S.

Many important features are shown: villages, towns, and cities; railroads, roads, highways, and transmission lines; rivers, streams, ponds, and lakes; prominent structures, underpasses, water towers, and race tracks; coastal and terrain features with elevations; light-lines and beacons with their code symbols; airways and caution or danger areas; airports, emergency and auxiliary fields; radio ranges with frequencies, codes, and magnetic headings; larger commercial radio stations with call letters and frequencies; and much other information of value to you in flight. Sectional charts are desirable for most flights.

Regional Aeronautical Charts: Scale, 16 miles to the inch (1:1,000,000). 17 cover the U.S.

Only the most prominent check points are indicated. These charts cover more territory but show few details. In flight, Regionals may be more satisfactory to use when you are flying fast airplanes.

Check the scale of all charts and don't mix them.

Radio Direction Finding Charts: Scale, 32 miles to the inch (1:2,000,000). 6 cover the U.S.

Use these charts especially for plotting radio bearings. Compass roses on the charts are oriented to magnetic north. Use the compass roses for plotting bearings.

Aeronautical Flight Charts: Scale, 16 miles to the inch. For established flight routes.

Aeronautical Planning Charts: Scale, 80 miles to the inch (1:5,000,000) and 47 miles to the inch (1:3,000,000). 1 Chart for the U.S. in two sizes.

This chart is accurate for measuring distances between widely separated points in the United States. An overprint on the chart shows the limits of the Sectional charts. First, get the overall picture of your flight on the Planning chart, then get the Sectional charts you need.

Radio Facility Charts (various scales): These charts contain all radio and communications data. All are contained in T.O. No. 08-15-1, issued monthly. Be sure the copy in your airplane is the latest.

Aeronautical Planning Charts: World coverage.

Long Range Navigation Charts: World coverage.

World Pilotage Charts: Partial world coverage.

Aeronautical Approach Charts: For limited strategic areas.

Miscellaneous Charts: There are other charts, of various scales, that you may use in combat. They will be issued and explained by your Briefing or S-2 Officers.

British Charts: In the ETO you may be issued British charts. They are similar to ours in many ways, but have different symbols and color gradients. If you know the charts used by the AAF, you'll have little difficulty in understanding the British charts.

CHECK POINTS

Aeronautical charts show prominent landmarks and terrain features to aid you in flight. Learn which check points to use for different flight conditions.

Check points must stand out clearly from surrounding features.

They must be distinctive—so you won't confuse them with similar points.

They must be easy to recognize under the conditions and time of day of your flight.

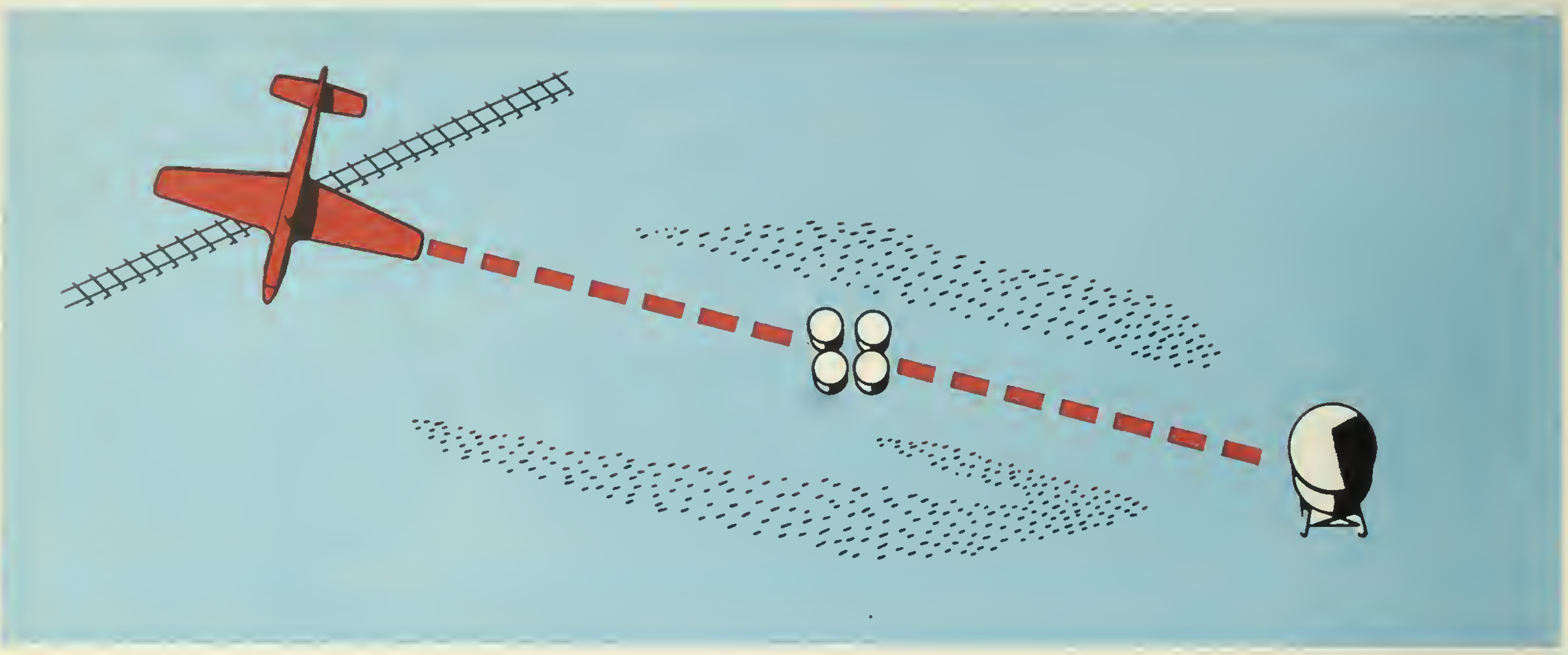
They should be spaced conveniently along your course, close enough to keep you on course—far enough apart so that you won't be completely occupied picking out check points.

Don't get into the habit of looking for check points only on one side of your course.

A positive check point should be at the point of each turn you make in flight.

CONDITIONS	GOOD CHECK POINTS	POOR CHECK POINTS
HEAVILY POPULATED AREAS 	Large cities with definite shape. Small cities with some outstanding check point; river, lake, structure, easy to identify from others. Radio aids, prominent structures, speedways, railroad yards, underpasses, rivers and lakes. Race tracks and stadia, grain elevators, etc.	Small cities and towns, close together with no definite shape on chart. Small cities or towns with no outstanding check points to identify them from others. Regular highways and roads, single railroads, transmission lines.
OPEN AREAS FARM COUNTRY 	Any city, town, or village with identifying structures or prominent terrain features adjacent. Prominent paved highways, large railroads, prominent structures, race tracks, fairgrounds, factories, briges, and underpasses. Lakes, rivers, general contour of terrain; coastlines, mountains, and ridges where they are distinctive. Radio Aids.	Farms, small villages rather close together, and with no distinguishing characteristics. Single railroads, transmission lines and roads through farming country. Small lakes and streams in sections of country where such are prevalent, ordinary hills in rolling terrain.
FORESTED AREAS 	Transmission lines and railroad right-of-ways. Roads and highways, cities, towns and villages, forest lookout towers, farms. Rivers, lakes, marked terrain features, ridges, mountains, clearings, open valleys. Radio Aids.	Trails and small roads without cleared right-of-ways. Extended forest areas with few breaks or outstanding characteristics of terrain.

CONDITIONS	GOOD CHECK POINTS	POOR CHECK POINTS
MOUNTAINOUS AREAS 	Prominent peaks, cuts and passes, gorges. General profile of ranges, transmission lines, railroads, large bridges over gorges, highways, lookout stations. Tunnel openings and mines. Clearings and grass valleys. Radio Aids.	Smaller peaks and ridges, similar in size and shape.
COASTAL AREAS 	Coastlines with unusual features. Light houses, marker buoys, towns and cities, structures. Radio Aids.	General rolling coastline with no distinguishing points.
SEASONAL CHANGES 	Unusually shaped wooded areas in winter. Dry river beds if they contrast with surrounding terrain. Dry lakes.	Open country and frozen lakes in winter unless in forested areas. Small lakes and rivers in arid sections of country—in summer—when they may dry up. Lakes (small) in wet seasons in lake areas, where ponds may form by surface waters.
IN GENERAL 	Some general features, often as far as 40 or 50 miles away, may make good check points, especially in flat country. Abrupt changes in physical appearance: mountainous to flat areas, forests to farms, etc.	



Lines of Position

In flight, establish as many lines of position as possible. For example, the pilot in the illustration above, as he crosses a railroad, lines up distant tanks and a tower as an off-course position check, in addition to on-course check points.

Correcting Charts

Note errors or important features not shown on your charts. This is important, especially in some of the remote theatres, because charts covering these areas have been compiled from meager and sometimes unreliable information. New information will be valuable in compiling new charts.

Turn in corrected charts to operations. They will forward the information to Aeronautical Charts Service, Washington, D. C.

Memory Pilotage

If you operate over a certain section of the country frequently, study the outstanding characteristics of the terrain in relationship to your charts. Know this territory well so that you won't have to refer to your charts so frequently.

In flight, keep charts away from open window.

DEAD RECKONING

Simple dead reckoning is the basis of all navigation. To use it successfully **make accurate calculations before your flight.** Then keep working during the flight. Because you hit one or two check points on the nose doesn't mean your destination is in the bag. Good navigation depends on checking your position constantly until you are over the field or target for which you set out.

Computers

Use of a computer is advisable for making accurate and speedy calculations.

The D-4 type computes speed, time, and distance; fuel consumption; true airspeed; and corrects altimeter readings for temperature. This computer fits in the pocket, and can be read at night under any light including ultra-violet. Consult T.O. 05-35-24 for details of operation.

The E6-B type is useful for all calculations, including groundspeed and wind drift. Details of its operation for pilots are in T.O. 05-35-9.

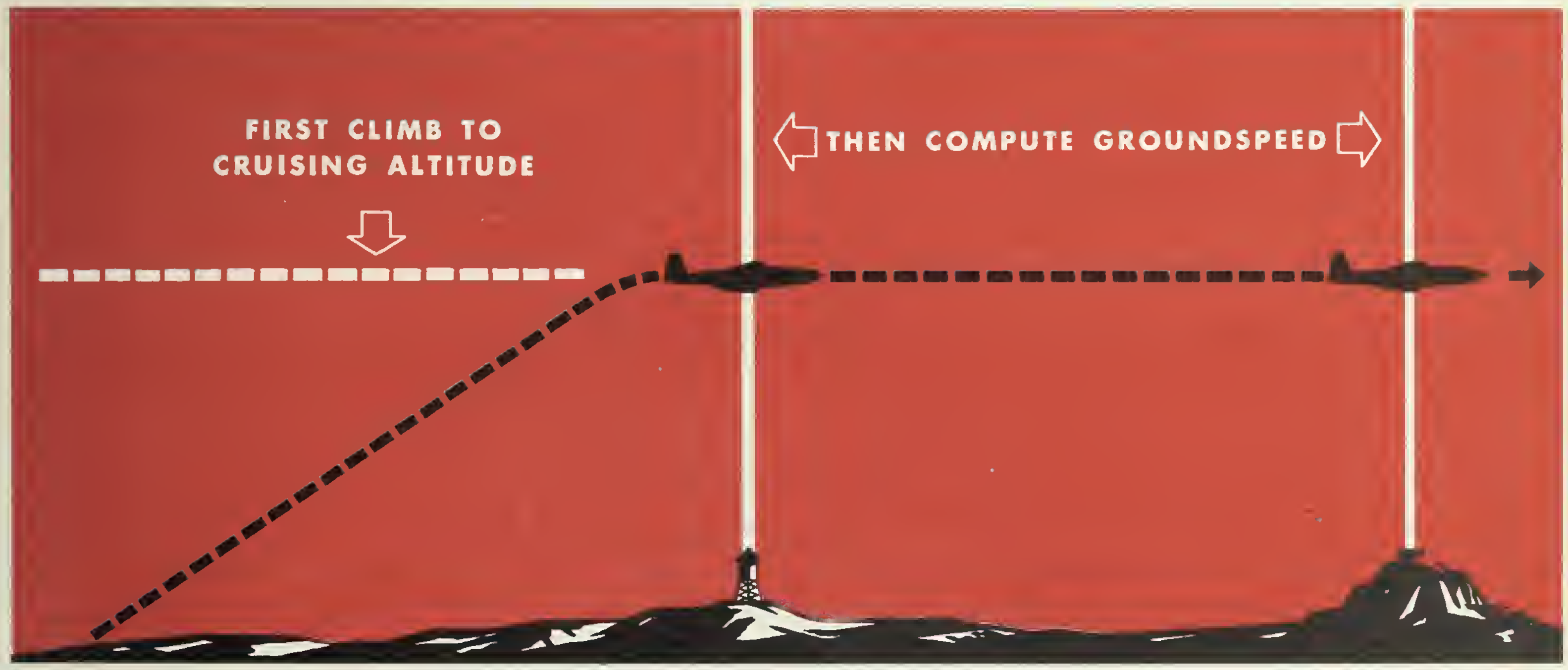
Both types are available ordinarily in all operations offices for pre-flight calculations, if you don't have one of your own.

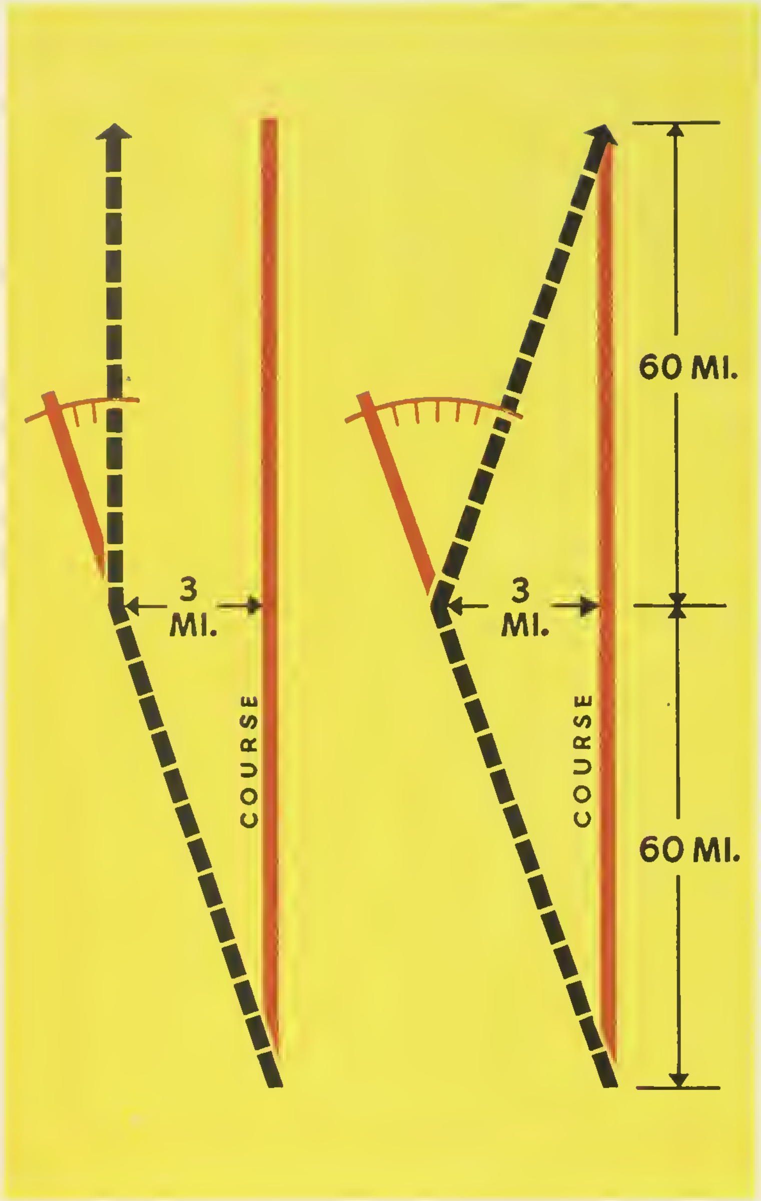
Computers are always valuable for contact flight and indispensable for instrument flight.

ETA'S and Check Points

Measure the distance on your chart between important check points, so you can note the time when you pass each point. Then it is a simple matter to figure your groundspeed and ETA to the next point.

Don't compute groundspeed, however, on the time it took you to fly from point of takeoff to the first check point. You use climbing airspeed to traverse part of this distance, and pass through regions of varying wind direction and velocity to reach cruising altitude. By the time you reach your first check point, ordinarily you have reached cruising altitude and airspeed. Mark down the time over this first check point; then compute immediately the time to your second check point, and so on throughout your flight. **Write down times over each check point.**


FIRST CLIMB TO CRUISING ALTITUDE
THEN COMPUTE GROUNDSPEED



GETTING BACK ON COURSE

If you have flown for 60 miles, each mile you are off course is equal to one degree off course. For every mile you are off course, correct 1°. You are then paralleling your course. By correcting 2° for every mile off course you will be back on your intended course in 60 miles. This works proportionately.

Time, Distance, and Groundspeed

Failure to recognize the relationship of time and distance to groundspeed is a common error.

Naturally, you can't compute your ETA correctly without first having computed your groundspeed correctly. If the distance between check points is large, some pilots start worrying too soon about the next check point. Then they begin to circle around aimlessly, and get lost.

Never confuse true airspeed with groundspeed when considering your ETA over a check point.

Remember these Tips

Deviation

Deviation in compass error. **Apply it to magnetic course** on every flight. Ordinarily you are interested only in the "M to C" side of the compass card.

Variation

East variation is a minus correction. West variation is a plus correction. Remember: "East is least."

Fuel Consumption

Work a fuel consumption problem on a computer as you work a time, speed, and distance problem, except substitute gallons for miles, and gallons per hour for miles per hour.

Compass Course

Correct true heading for variation to get magnetic heading. Using your compass card, apply deviation to magnetic heading to obtain compass heading, the one you fly.

Groundspeed in Flight

To compute your groundspeed in flight, check time accurately between check points. Divide distance travelled by time in hours. To obtain accurate groundspeeds check your position over such features as rivers, railroads, roads, and water towers.

DON'T WANDER

When your ETA over a turning point is up and that point is not yet in sight, continue on-course for a reasonable time. If you still can't see it, return to your last positive check point. Don't wander aimlessly.

Wind

Compute wind drift for each leg of your flight. The difference between your ETA and your actual time of arrival is a variable influenced mainly by wind. You can control airspeed but not the effect of wind on your airplane. Therefore, in addition to obtaining winds aloft information before takeoff, check winds continually during flight, and each time you land during a cross-country.

In flight, you are not only moving over the ground, but through an air mass. Air is always in movement, and it is this fact which makes proper wind drift calculations so important.

Wind Triangle Principle

Draw a wind triangle for each leg of your flight if you are not using a computer to figure wind drift.

In a wind triangle the elements always pair up, each pair representing a side of the triangle.

The elements combine as follows:

True Course (Track) and Groundspeed
True Heading and Airspeed
Wind Direction and Velocity

The angle between true course and true heading is the angle of drift. Always correct this number of degrees **into the wind.**

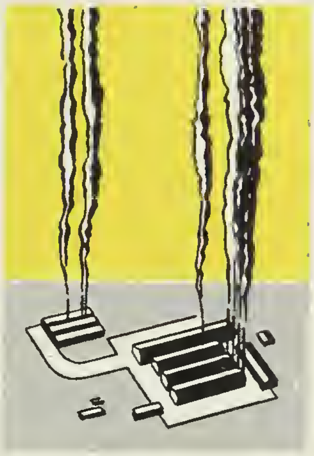
Wind Over Land

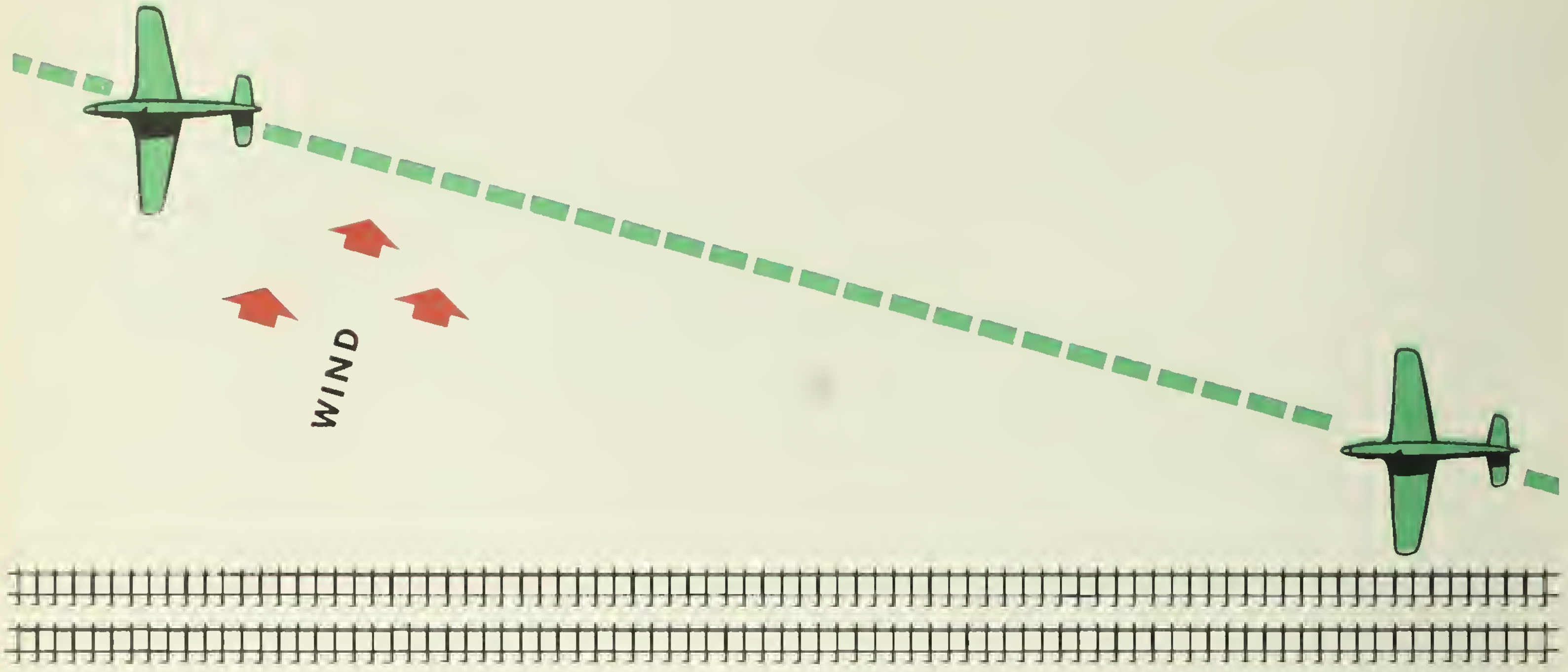
Most flights are over or within sight of land.

A good way of determining wind direction is by watching smoke drift. If it is calm smoke rises vertically.

Direction of cloud shadows moving across the ground gives a good indication of wind direction at the level of the clouds.

Do not consider smoke from trains unless you allow for the movement of the train.





To Find Drift at a Desired Altitude

1. Find a road, railroad, or power line that heads in the general direction of your flight.

2. Use the magnetic heading of the object to steer a parallel course.

Wind and Temperature

Watch for abnormal changes in temperature. They are accompanied always by a change in wind direction. Consequently they change your airspeed and drift.

Wind Over Water

Find wind direction and velocity by watching the surface of the sea. At an altitude of 2000 feet or less, with no cloud formations between the airplane and the surface of the sea, the direction and velocity of the wind (for all practical purposes) is the same as the surface wind.

Wind Direction

Crest lines of the smallest ripples on the sea surface are perpendicular to the direction of the wind. The foam or white caps that form on the water always appear to slide into the wind. Actually the foam is left on the water by the white caps; as the waves advance, the foam is left behind them.

Check wind direction by noting crest lines on the surface of the water. Obtain true direction of the wind by noting its relative bearing from the true heading of the airplane.

Wind Force

Keep in mind the following sea descriptions. Use them as a guide, but change them if experience dictates.

Wind force is divided into six phases:

1. 0-4 mph; When there is no wind the sea is calm and the surface is glassy. Ocean currents look like long winding rivers on the surface of the sea. As the wind increases, the sea is rippled in patches. These rippled patches stand out as clearly as a green field surrounded by brown foliage.

2. 5-7 mph; Entire surface of the sea is rippled.

3. 8-13 mph; Scattered white caps make their first appearance with the entire surface having a definite wave formation.

4. 14-18 mph; The surface of the sea looks rough. There are enough white caps on the surface to give it a spotted appearance. The foam made by these white caps now stays on the water for the first time.

5. 19-24 mph; The foam is blown over the top of the waves in the form of a spray. This spray is easy to see, and marks a definite phase in the force of the wind.

6. As the wind increases above 25 mph the sea becomes foamy and the spray gets thick.

RADIO AIDS

Radio aids are valuable in all navigation, contact or instrument. Most information concerning radio aids is contained in sectional, regional, and radio facility charts.

Following is a list of radio aids and their most important uses to the pilot.

Radio Ranges

200-400 kc frequency band. A few ranges use the 400-550 kc frequency.
Identification signal every 30 seconds.
Use ranges and stations as check points in pilotage. Obtain frequencies, identifications, and headings from charts and radio facility charts.

Cone of Silence

Directly over range station. Use as radio check point.

Station Location Marker

Reference check point to identify location of cone of silence. 75 mc visual indicator signal.

Fan Markers

75 mc visual indicator signal on legs of radio ranges. Positive position indicator. Shown on charts. **Make position reports to range station from this point.**

Air Traffic Control Towers

Various frequencies. Voice broadcasts. Can be used as homing device with radio compass in emergency upon request.

Commercial Stations

Various standard frequencies. Frequency and call letters shown on charts. Use in plotting fixes or as check points. Use with radio compass as homing device.

AACS Stations

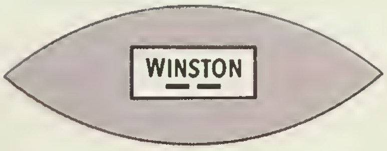
Indicated on charts and radio facility charts. Obtain latest flight information from these stations.

PRECAUTIONS

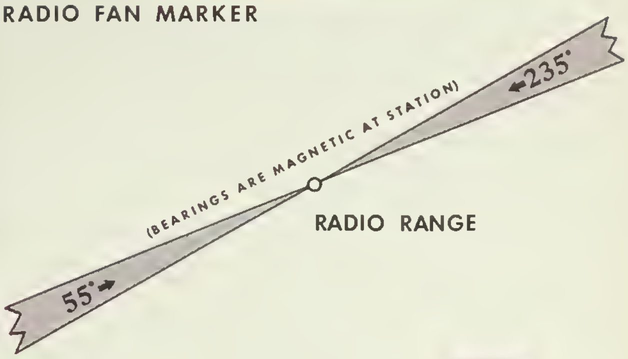
Never rely on radio navigation alone. Always use radio ranges with other methods of navigation.

Then, if your radio goes out you can still follow your flight plan. Radio facility charts are no substitute for aeronautical charts.

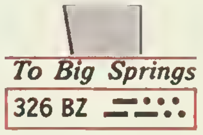
Static is the greatest hazard to radio navigation.



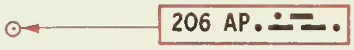
RADIO FAN MARKER



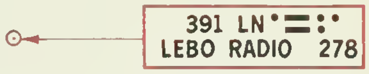
RADIO RANGE



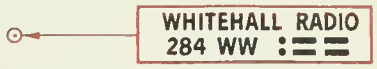
RADIO RANGE NOTE



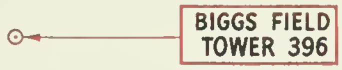
RADIO RANGE (WITHOUT VOICE)



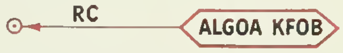
RADIO RANGE (WITH VOICE)



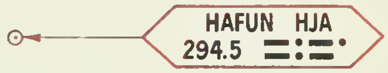
RADIO RANGE (SIMULTANEOUS)



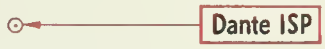
AIRPORT CONTROL TOWER



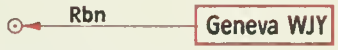
RADIO DIRECTION FINDER STATION



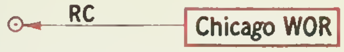
RADIO BEACON



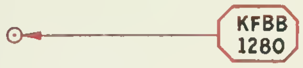
RADIO COMMUNICATION STATION



RADIO COMMUNICATION STATION (WITH RADIO BEACON)



RADIO COMMUNICATION STATION (WITH DIRECTION FINDER)

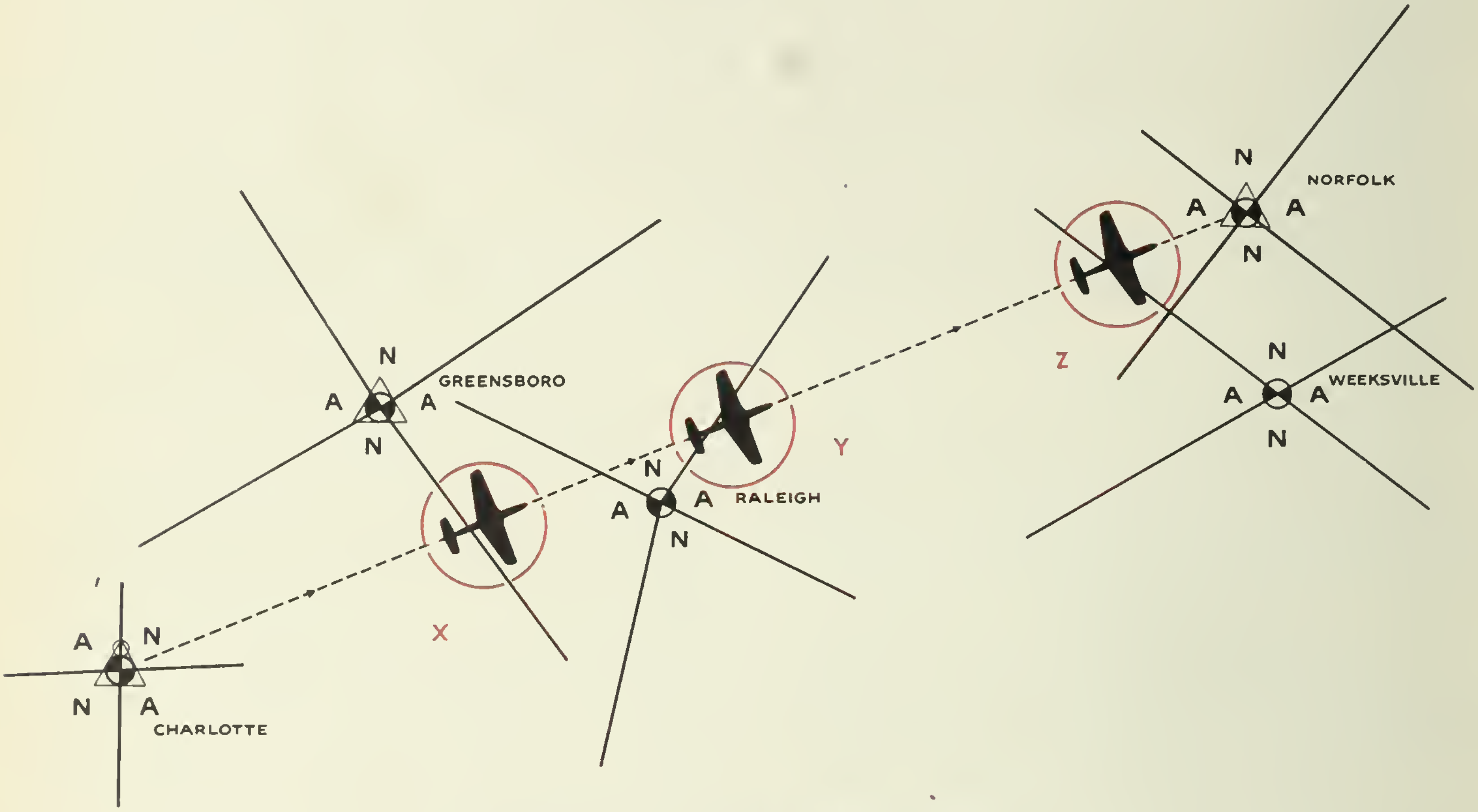


RADIO BROADCASTING STATION

During electrical storms radio reception is sometimes impossible, making it necessary for you to use other methods. Rain may short out some receivers.

Sometimes you can't make contact with range stations more than ten miles away because of atmospheric conditions. Don't get panicky or think immediately that your radio is out. Fly out your ETA over the station and try contact again before concluding you are off-course.

Most range stations are equipped for voice broadcasts. Whenever conditions are favorable to reception, use your receiver on "BOTH." For normal use keep receiver volume as low as possible. In severe static conditions switch filter to "RANGE" or "VOICE" (whichever you desire) and increase the volume until you make contact or receive signal.



RADIO NAVIGATION

Use radio range beam legs just as you use visual check points. Use them at all times on both instrument and contact flights.

This method of navigation, when used in conjunction with other aids at your disposal, makes the most routine flight interesting; and assures accuracy and safety on all cross-country flights.

Here is an example:

A pilot takes off from Charlotte for Norfolk. After takeoff he tunes to Greensboro range. He determines his position in area of X thus: if west of Greensboro southeast leg he hears Greensboro N signal; if east, the Greensboro A signal. In both cases strength of the background (on-course) signal determines his proximity to Greensboro southeast leg. Solid on-course signal of Greensboro southeast leg indicates general position along line of flight.

After crossing Greensboro southeast leg he tunes to Raleigh range, receiving Raleigh A signal. As he progresses he hears first the on-course signal of the Raleigh northwest leg, followed by the Raleigh N signal, then the on-course signal of the Raleigh northeast leg. This establishes his position in area Y.

Flying from area Y, and until he crosses northwest leg of Weeksville range, he can tune to either Raleigh A signal or Weeksville A signal. After crossing Weeksville northwest leg he tunes to Norfolk and hears Norfolk A signal. He can also tune to Weeksville and get Weeksville N signal.

If he were far off-course to the south he would hear Weeksville or Norfolk N signal. If in doubt as to whether off-course to the north or south he could make a leg identification check on either the northwest or southwest leg of the Norfolk range.

IMPORTANT

Use the following four steps in solving any orientation problem. They work for any range station, using any orientation procedure and, if worked in sequence, guarantee successful arrival at station.

1. Identify the range station.
2. Identify your position as N, E, S, or W of the station by fade or build.
3. Intersect and identify a beam leg.
4. Fly this beam leg to the station.

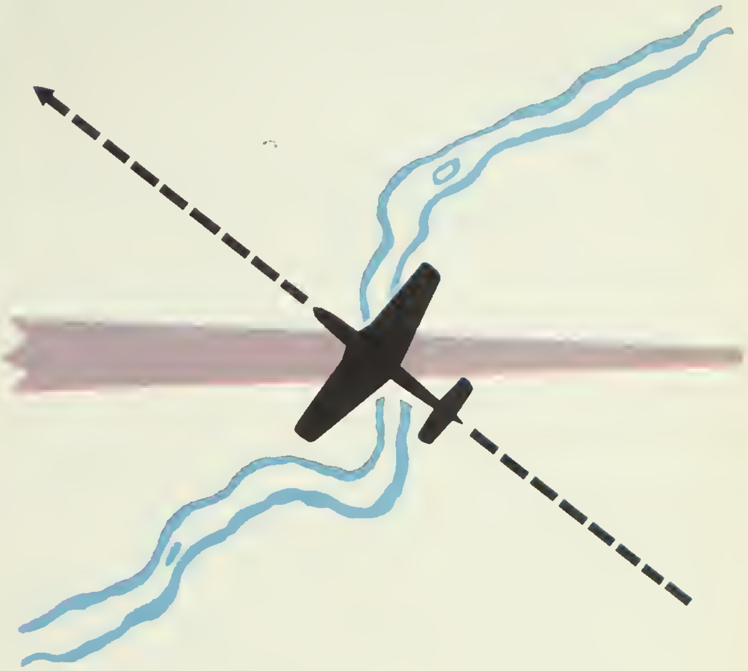
International Morse Code

International Morse Code is used for all code signals in radio navigation.

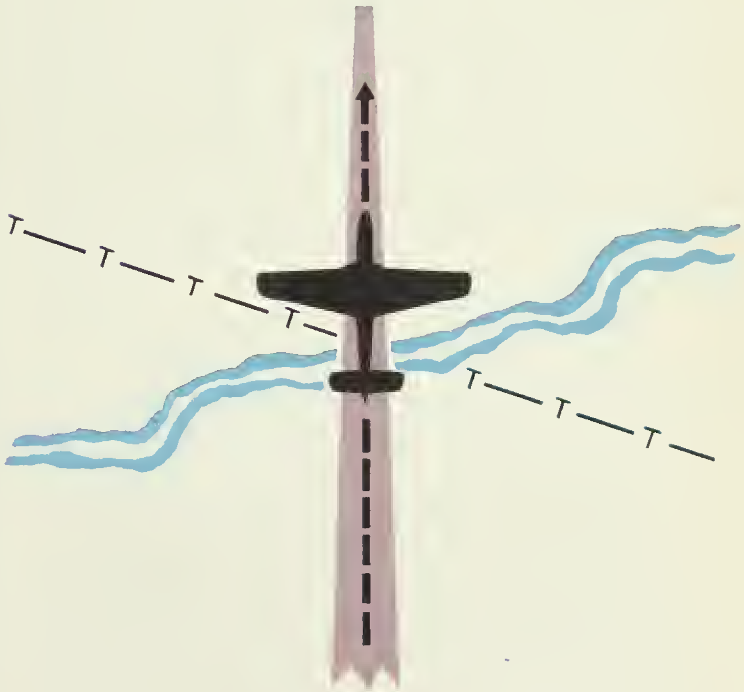
A	· –	M	– –	Y	– · – –
B	– · · ·	N	– ·	Z	– – · ·
C	– · – ·	O	– – –	1	· – – – –
D	– · ·	P	· – – ·	2	· · – – –
E	·	Q	– – · –	3	· · · – –
F	· · – ·	R	· – ·	4	· · · · –
G	– – ·	S	· · ·	5	· · · · ·
H	· · · ·	T	–	6	– · · · ·
I	· ·	U	· · –	7	– – · · ·
J	· – – –	V	· · · –	8	– – – · ·
K	– · –	W	· – –	9	– – – – ·
L	· – · ·	X	– · · –	0	– – – – –

Radio and Visual Check Points

Use radio aids in connection with visual check points as an easy method of determining position.



Pilot flying off airways knows exact position at beam intersection by using both beam and river as check points.



Pilot flying beam knows exact position by watching for transmission line.

Numerous similar examples occur on any cross-country flight.

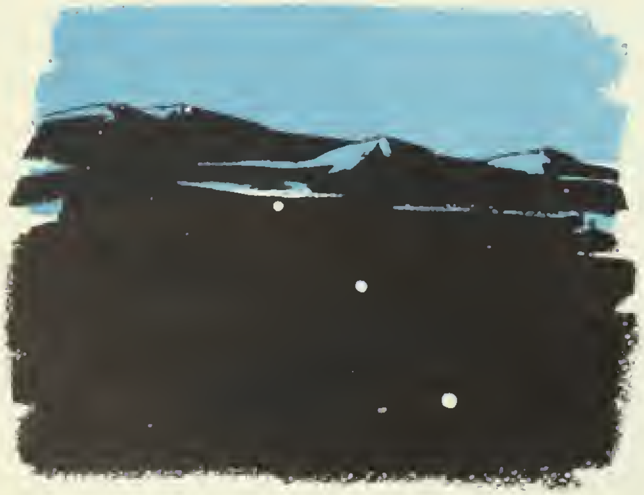
NIGHT NAVIGATION

There is nothing difficult about night navigation if you plan your flight carefully before you take off. Many of the check points you use during the daytime are not visible at night. But to replace them, there are other aids to night flying. Sometimes at night radio navigation is the only method of navigation that can be used.

Prepare your charts. Most aeronautical charts now are treated so that they will show up at night under ultra-violet, red, or amber cockpit lights. Use treated pencils for making charts for night use so that lines will stand out prominently under ultra-violet cockpit lights.

1. Prepare a timetable showing what headings to fly and how long to fly them.
2. Study your charts and mark the prominent check points that are visible at night.
3. Use radio navigational aids constantly. They are your most valuable aid at night.
4. Take a flashlight on every night mission. Your instrument lights may fail.

GOOD CHECK POINTS



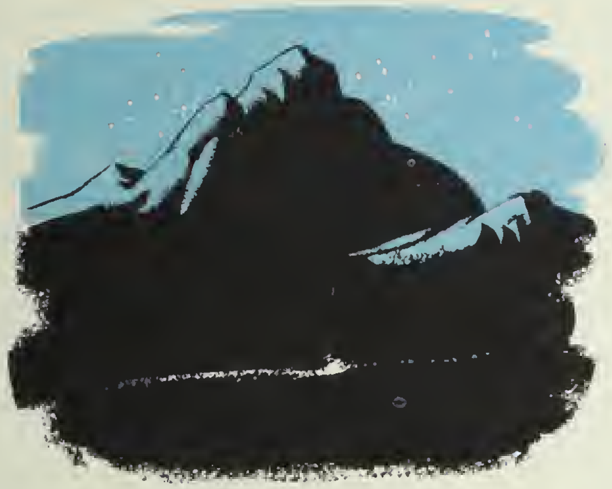
Light Lines

Beacons

Airports (Lighted)

Prominent towns and cities in open regions with a concentration of lights.

Highways along your flight path: Headlights of cars are easy to see.



Prominent terrain features; ridges and mountains silhouetted against the horizon.

Coastlines, lakes, and rivers on clear nights—water reflects light.

Radio Aids at Night

Radio aids are among your best check points for night navigation. Often they are indispensable, but get into the habit of using visual check points also. Your radio may not always work.

Light Lines

Light lines are your best visible check points for night flying. They consist of beacons, 10 to 15 miles apart along airways, some of them with rotating beacons and code signals. If you are reasonably sure of your heading and general location when you first sight a light line, you can follow it easily with little chance of straying.

Code signals are red and are visible six times each minute **along the airway**. They are easy to see if you look for them; if you know your general position, look for a light line, identify a code letter and look for it on your chart. It will indicate your exact position. Light lines are coded in a sequence of ten signals, then start over again. Use the following key for checking the order of signals. The initial letter of each word is the signal:

• — —	• • —	• • • —	• • • •	• — •
When	Undertaking	Very	Hard	Routes
— • —	— • •	— • • •	— — •	— —
Keep	Direction	By	Good	Methods

The series keeps rotating from an arbitrary starting point on the chart.

If you follow the light line from the opposite direction, code signals will appear in reverse order.

Beacons displaying a green signal in addition to the rotating beacon have lighted landing facilities near them.

POOR CHECK POINTS

Small towns in fairly congested areas which do not stand out clearly.

Roads, transmission lines, most structures easy to recognize in daytime.

Railroads.

General features of terrain—they seem to melt into the contour of the land.

WHAT TO DO WHEN LOST

Daniel Boone, the great wilderness scout, was being interviewed by a writer assigned to do a story of his life as one of America's great pioneers. "In all your wandering around in the wilderness, Dan'l, didn't you ever get lost?"

The old woodsman thought awhile, checking through his experiences of a lifetime, then looked up at his interviewer. "No, don't ever recollect bein' lost," he answered thoughtfully. "Been **bewildered** four or five days."

Lost is a relative term. You started somewhere. You know how long you've been on your way. You know what general direction you've travelled. So you must be within a general area that you can outline on your charts.

You passed some known check point at an estimated if not exact time. And you flew in a general direction for a distance that you can approximate since you passed that check point. That further cuts down the area where you're bewildered.

Remember, you're not lost until you say you are.

Don't get excited.

Don't wander; hold your heading.

Use one of the following procedures to locate your position:

Contact Flight (Day)—Radio Not Operating

1. Estimate flying time on remaining gasoline.
2. Hold original heading.
3. Estimate position from last known check point based on TAS and elapsed time.
4. Try map orientation to locate next check point.
5. If unable to establish position definitely, set course from approximate position to intersect such prominent running landmarks as a river, coastline, mountain range, double-track railroad, etc.

If gas supply is not sufficient to reach destination from established position, set course to nearest airport or auxiliary field.

Night Flight—Radio Not Operating

1. Estimate flying time on remaining gasoline.
2. Estimate position from last known check point based on TAS and elapsed time.
3. Hold straight course which will eventually intersect a beacon line; follow line to auxiliary field.

Location by Radio—Day or Night

1. Estimate flying time on remaining gasoline.
2. Turn radio to "MANUAL". Tune in loudest station; identify it with Radio Facilities Chart. Try two-way communication; request assistance from AAF Flight Service. All stations guard frequencies of 4495, 3105, and 6210.
3. If two-way communication cannot be established, use Radio Facilities Chart; by tuning in three or four ranges in succession, noting A or N quadrants, locate general area in which you are flying. Attempt to contact radio range every 15 to 20 minutes. Listen to radio range for instructions.

Finally

When gas is down to twenty minutes supply, locate a large field and make a wheels-up landing. If at night or on instruments, pull up to 2000 feet or over, and bail out.

SECTION 8 EMERGENCIES

TO BAIL OR NOT TO BAIL

It is obviously impossible to give a definite set of rules on when to bail out and when not to. Every emergency presents a different set of conditions. The final decision is always up to the pilot.

In an emergency, try to save your plane by bringing it in for a normal or forced landing if it is reasonably possible. Engine failure on a multi-engine airplane is not an automatic signal for bailout. Jettison cargo, bombs, or auxiliary tanks if necessary, and try to continue under power to a safe landing place.

In general, make a forced landing rather than bail out under the following conditions:

1. When you have wounded men aboard.
2. When your airplane and its equipment are needed for survival after you are down—in the Arctic, jungle, or desert.
3. Over water, in airplanes except fighter types, ditching has the advantage of keeping the crew together in one or more dinghies. The dinghy radio, flares, rations, water, and other emergency equipment increase your chances of survival.

In general, when you are faced with the immediate decision of whether to bail out or try a forced landing, choose bailout under the following conditions:

1. **Loss of control**—When for any reason you are unable to control your airplane, bail out when you reach your predetermined critical altitude.

2. **Unfavorable terrain**—Bail out when in trouble over mountains, wooded areas, or flat terrain that appears too rough for a safe forced landing.

Over water, bail out from a fighter plane rather than try to ditch it.

3. **Uncontrollable fires**—Use all available equipment to try to put out a fire, but don't fight it too long. As soon as you find you can't control it, get out as fast as you can.

4. **Limited visibility**—If you have flying power but know you must land or bail out soon, try to determine type of terrain below and location of emergency landing fields. If unsatisfactory, gain sufficient altitude and prepare to bail out. If flying power is not available, bail out, unless you have at least a 1000 foot ceiling and terrain is satisfactory for a forced landing.

When leaving on any flight that will take you over the jungle, the desert, the Arctic, or any rugged country, wear shoes that you can walk home in, and wear clothes for the climate.

Forced Landings

Any crash landing that you can walk away from is a good one. Forced landings in which there is a minimum of damage to the airplane or injury to the crew are the result of forethought, calm execution, and adherence to a few fundamental principles. The following suggestions will help you. Think them over. Plan in advance for that day when you are confronted with a forced landing.

1. Start looking for a spot where you can land while you still have fuel enough to be choosy.

2. Jettison bombs, fuel, cargo, and unnecessary equipment. Lightening the airplane lowers the landing speed, and also may keep you in the air long enough to make an airfield. Throw out all loose objects to prevent injury to crew on impact.

3. Open emergency escape hatches, otherwise they may jam on impact and delay exit. Do not open windows that may slam shut and jam at the time of the impact.

4. Land as nearly into the wind as you can, never over 90° from the wind.

5. Don't attempt turns near the ground; a stall may result.

6. Keep ample flying speed until the airplane is on the ground. There is a general tendency to stall out while making a forced landing.

7. Use flaps as you would in a normal landing.

8. Land wheels up on any type of terrain except a known airfield. If you land with the wheels down on rough ground the airplane is almost certain to nose over, increasing damage to the airplane and danger to the crew. (Exception: always crash land B-24 with wheels down.)

9. If you have power available, use it. Fly the airplane right down to the ground with ample speed. Don't try a stall landing.

10. Warn your crew in plenty of time so that they can get in position for the crash. Warn them again a few seconds before the actual contact with the ground so they can get braced. In general, positions of all crew members for a crash landing are the same as those for ditching.

11. Just before the crash, cut all switches and turn fuel selector valves off to avoid fire.

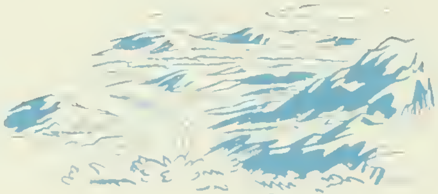
12. Try to land so the airplane has a chance to slow down instead of stopping suddenly. For instance: if there is a solid obstruction ahead, groundloop your airplane to kill the speed and get the wing in a position where it can absorb the blow.

13. After the airplane has stopped, grab first-aid kits and any other necessary equipment and get out fast. Get at least 50 feet away. There may be danger of fire and explosion.

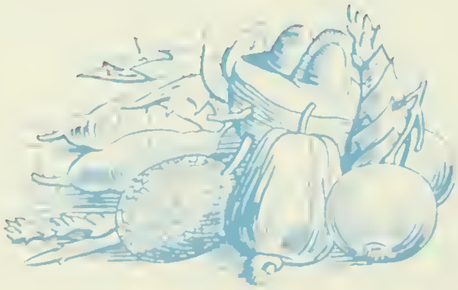
> In case of forced landing immediately after takeoff, land straight ahead. Don't try to turn back. Turning back to the field has killed many good pilots.

SURVIVAL AFTER FORCED LANDINGS

Your chances of survival after a successful forced landing in uninhabited areas depends upon the amount of preparation you have made for this emergency. Learn as much as you can about the area in which you are flying. You must know such things as:

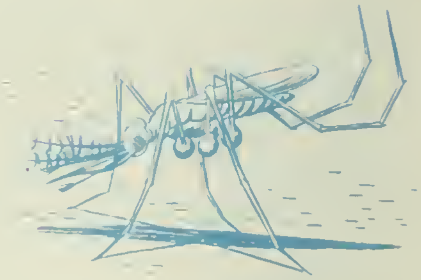


Type of terrain, and any prominent landmarks that can help you orient yourself.



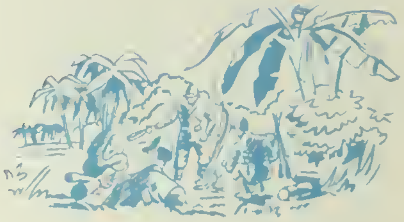
Kinds of foods you should look for.

Attitude of natives.



Natural dangers.

Health and first-aid precautions.



Approximate location of the enemy.

Rescue organization and procedure.

Your airplane and its equipment provide you with plenty of material to improvise shelter, signaling equipment, cooking utensils, etc.

Study your manual, "Survival". It gives a complete story of how to live off the land and make your way back home.

Some day you may be forced down at sea. You won't have time to look up the answers then, so now's the time to start preparing for such an emergency. Here's how to do it:

1. Know the proper procedure for ditching your airplane.
2. Know the use of emergency equipment provided for ditching purposes.

As pilot, you must not only learn your own ditching duties thoroughly, but must make sure that your crew members know theirs. Success depends on the speed and efficiency with which each member of the crew executes his assigned job, and upon the coordination of all efforts.

Conduct ditching and dinghy drills regularly. Your Personal Equipment Officer will help you work out a drill procedure.

Inspections

Before taking off on an over-water mission, make the following checks:

1. **Emergency equipment**—See that it is complete, properly stowed, and that it has been inspected as required.
2. **Escape hatches**—Make sure that they operate properly.
3. **Life vests**—Check your own and your crew member's. Blow the vests up by mouth and check the adjustment of waist and leg straps. Inspect CO_2 cartridge and see that valves are closed.

As soon as you have the slightest doubt that you can make land, give the order: "Prepare for ditching." Give your crew as much time as possible to carry out their ditching duties and get in position.

In addition to verbal warnings over the interphone, use the standard ditching signals: six short rings—"Prepare for ditching"; one long ring—"Brace for ditching."

Radio Procedure

Start emergency radio procedure immediately. Your best chance of being rescued lies in early and correct emergency radio procedure.

Specific radio procedure differs in various theaters of operations. Learn the instructions for your theater and make sure your radio operator knows them. If you have transmitted ditching signals and then find you can make land, notify the Air/Sea Rescue Unit as soon as possible so as to prevent useless search.

Jettisoning

Lighten the plane by jettisoning bombs, guns, ammunition, extra fuel and anything not essential to operation of the airplane. Throw out any objects lying loose or likely to be torn loose by the impact. Hold or firmly secure emergency equipment that you are going to take with you.

Emergency Exits

Close bomb bay doors after jettisoning bombs. Close all lower hatches to keep water out. Keep open top or upper side emergency exits through which you will escape. If closed, they may jam on impact. Close all bulkhead doors to stop the flow of water through the plane.

General Crew Preparations

Remove oxygen masks as soon as you are below 12,000 feet. Take off neckties and open collars. Remove heavy boots, but keep on flying clothing and helmet for protection.

Remove parachutes, except when you need the one-man life raft attached to the harness.

Do not remove life vests. Keep them on at all times. **Do not inflate until out of the airplane.**

If you inflate your life vest while you are still in the airplane, you will find it difficult, if not impossible to get out through the hatches.

Ditching Positions

All crew members must follow the standard ditching positions recommended for various combat planes in the AAF ditching posters.

If there is no poster on your airplane, or you can't use the positions recommended because of differences of stowage or structural variations, remember the following:

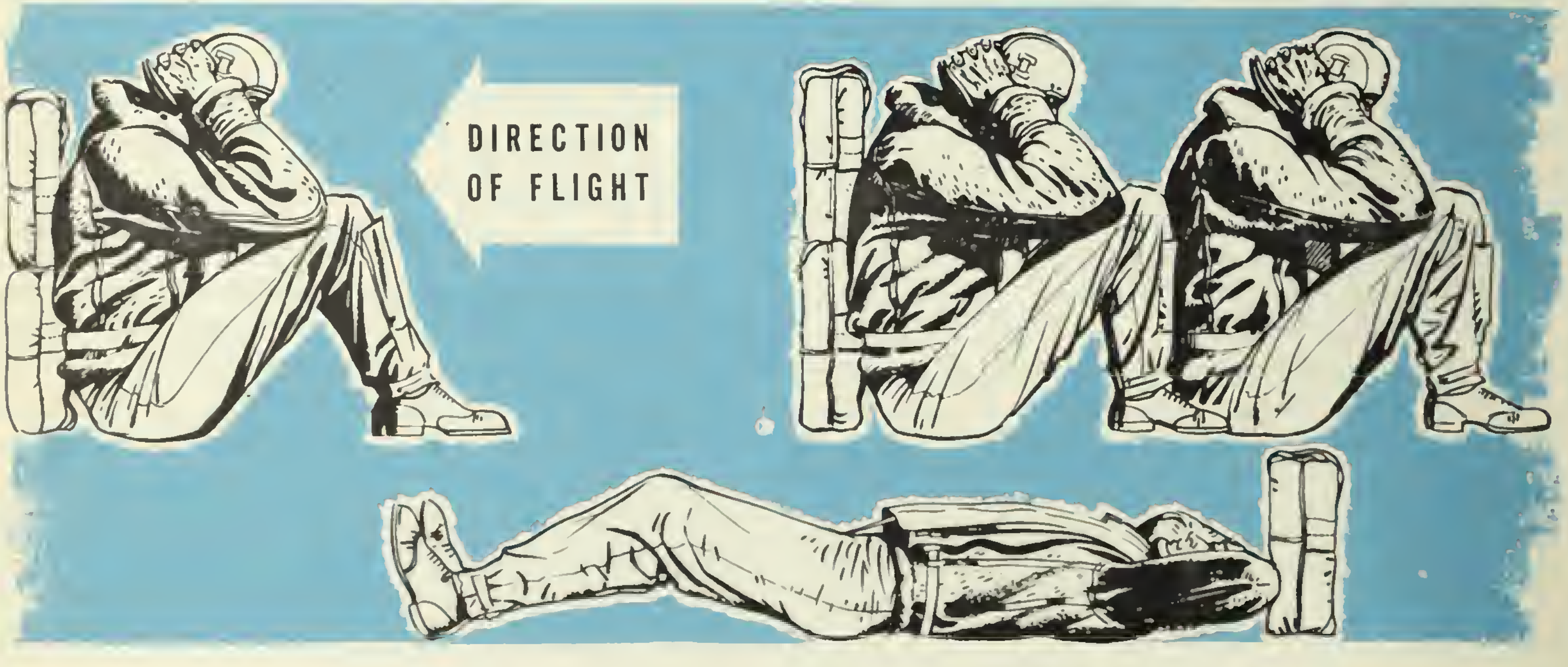
General Rules

1. The best ditching position is to sit facing the tail of the plane, knees drawn up, back and head braced against a solid structure. If your head extends above the support, clasp your fingers tightly behind it to hold it from being snapped back.

2. The second position is to lie on the floor of the plane, head to the rear and feet firmly braced against a solid structure. Bend the knees slightly. The best position for an injured man is the seated one. If such a position is not the injured man's regular one, have him trade places with someone. If there is not enough bulkhead room for all to brace against, if there are extra people in a compartment, it will be necessary for some to sit, facing aft, back braced against forward man's shins, feet and knees drawn up, hands clasped behind head.

3. Another position, in airplanes which are equipped with ditching belts, is to brace against the belts.

4. Pilot and copilot must have seat belt and shoulder harness fastened. Warn the crew five seconds before the impact so that they can brace for the shock. Stress that positions must be held until the airplane comes to a stop; casualties occur when men relax immediately after the initial impact.



DITCHING THE AIRPLANE

Wind and Surface Conditions

The sea is a tricky landing strip. So it is important to determine the wind's direction and velocity for a successful ditching. This is not easy to do, and it requires practice. Get in the habit of studying wave and swell formations on every flight, so that you'll become adept in estimating wind and sea conditions by surface disturbances.

Wind Direction

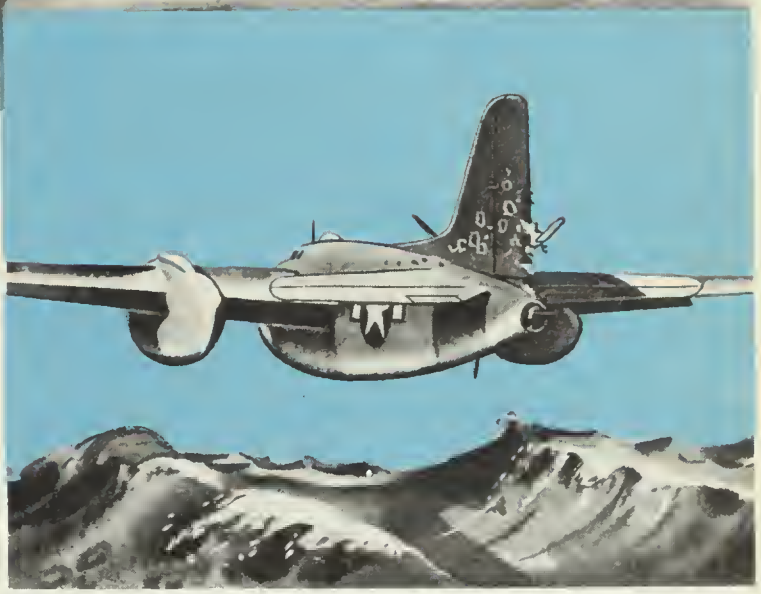
Waves are created by the wind and move downwind. Thus the line of the wind lies at right angle to the waves. Watch for white caps, or breaking waves. Waves break downwind. But the foam and spume of the breaking wave has the appearance of sliding down the **upwind** side of the wave. Usually you cannot determine wind direction unless the wind is strong enough to form white caps.

Look for wind lanes—series of alternate strips of light and shade. These are parallel to the wind.

It is easy to misjudge the direction of the wind by 180°. If possible, fly the plane parallel to the waves and watch the direction of the drift.

Wind Velocities

Few white caps	10 to 20 mph
Many white caps	20 to 30 mph
Streaks of foam	30 to 40 mph
Spray from crests	40 to 50 mph



Altitude

Altitude is extremely difficult to estimate over a calm, glassy sea.

One way to judge altitude is to have the radio operator reel out the trailing antenna until the weight hits the water. The radio operator advises when the current drops.

Use of Flaps

The amount of flaps to use depends upon the type of airplane and its condition. In general, when you have sufficient power to maintain control, you can safely use full flaps. When ditching without power, use lesser flap settings, particularly crosswind.

In aircraft with Fowler Type flaps, which usually do not tear off on the initial impact, the use of full flaps may cause severe diving tendencies.

The ideal flap setting is that which gives minimum rate of descent with minimum forward speed.

Use of Engines

The value of power in ditching cannot be overemphasized. Always plan to ditch before your fuel is exhausted.

Use engines to flatten the approach. If you have power on both sides of the airplane, use it to full if necessary. If power is available on one side only, do not use to such an extent that you cannot turn the airplane against the engine, right down to the stall with a margin of rudder power.

Approach and Touchdown

Maintain control so that you can choose the best spot for setting the airplane down on the water. Two fundamental rules for setting an airplane down on water are:

1. Ditch crosswind if wind is under 35 mph—no spray or streaks of foam on the sea.
2. Ditch into wind if its velocity is over 35 mph.

To ditch crosswind: line up with the crests, adjust power, flaps, and trim, and fly down with the minimum rate of descent and minimum forward airspeed until final contact with the water. Land on a crest if possible, crabbing if necessary.

When ditching into the wind, try to execute a spot landing on the upslope of a wave at or near the crest. **This is an extremely difficult maneuver.** Ditch crosswind instead whenever possible.

After choosing the best point at which to ditch, hold off if possible until you lose all excess speed above the stall. Set down aircraft with conventional landing gear in a 3-point attitude. Set down aircraft with tricycle landing gear in the normal landing attitude for such airplanes.

There will be a primary impact as the tail strikes the water. This will be followed by a severe impact with violent deceleration as the nose goes in.

ABANDONING THE AIRPLANE

Do not operate the manual raft release until the airplane comes to rest. Don't hold on to the manual release before or during ditching. You may inadvertently pull it.

Take out raft accessories kits, emergency radio, extra signalling equipment, navigation kit, extra rations and water, and anything else you need. The items each man will take should be designated in the dinghy drills.

Inflate your life vest as soon as you are out of the airplane.

Boarding the Life Raft

Launch and board rafts from the wing tips if possible, to avoid damaging rafts on jagged edges.

Don't jump into the raft; you'll go right through the fabric. If the raft is inverted, don't jump on it. You will only expel the air underneath and make the raft more difficult to turn over. Right it from the wing of the plane if you can.

Paddle away from the plane and tie the rafts together if there are more than one. Stay near the plane as it is easier for rescuers to spot you.

FIGHTER AIRPLANES

It is better always to bail out of a fighter if you can, as the risk in ditching a fighter is greater than in jumping. Most fighters do not stay afloat more than a few seconds. Also, ditching does not provide you with any more equipment than you have when bailing out.

If your airplane is damaged at a low altitude you may not be able to gain enough altitude to bail out. In this case you have to ditch; you haven't any choice. Follow specific instructions for ditching the type of fighter you are flying.

RADIO PROCEDURE

Definite radio procedures are necessary when you have decided to bail out over water. Each theater has its own radio procedure. You will get the full details when briefed for a mission.

If there is opportunity and time, try to gain altitude, especially if below 5,000 feet. This increases the range of your transmission and helps Air Sea Rescue Units get a good VHF fix. How quickly you are rescued is determined by the accuracy of the fix. Given below is a typical radio procedure for bailout over water:

a. Gain altitude if possible.

b. Notify wingmen that your airplane is in trouble.

c. Turn IFF to **"emergency."** This transmits an IFF distress signal until the ship hits.

d. On operating channel, if there is time, call operations control, giving altitude, course and airspeed.

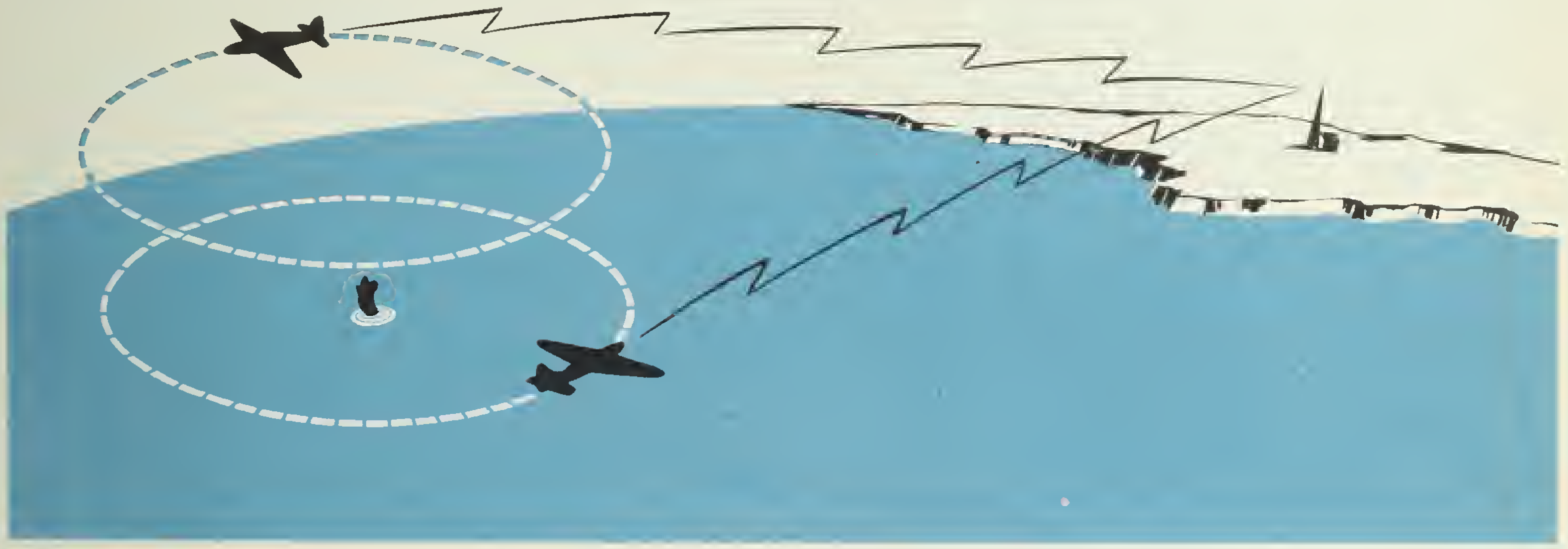
e. Switch to "Mayday" channel.

f. Call "Mayday."

g. Repeat call sign three times (it is essential that the airplane be identified by squadron call and airplane number after calling Mayday). If time permits after calling Mayday, listen out on the Mayday channel for a reply from the controller.

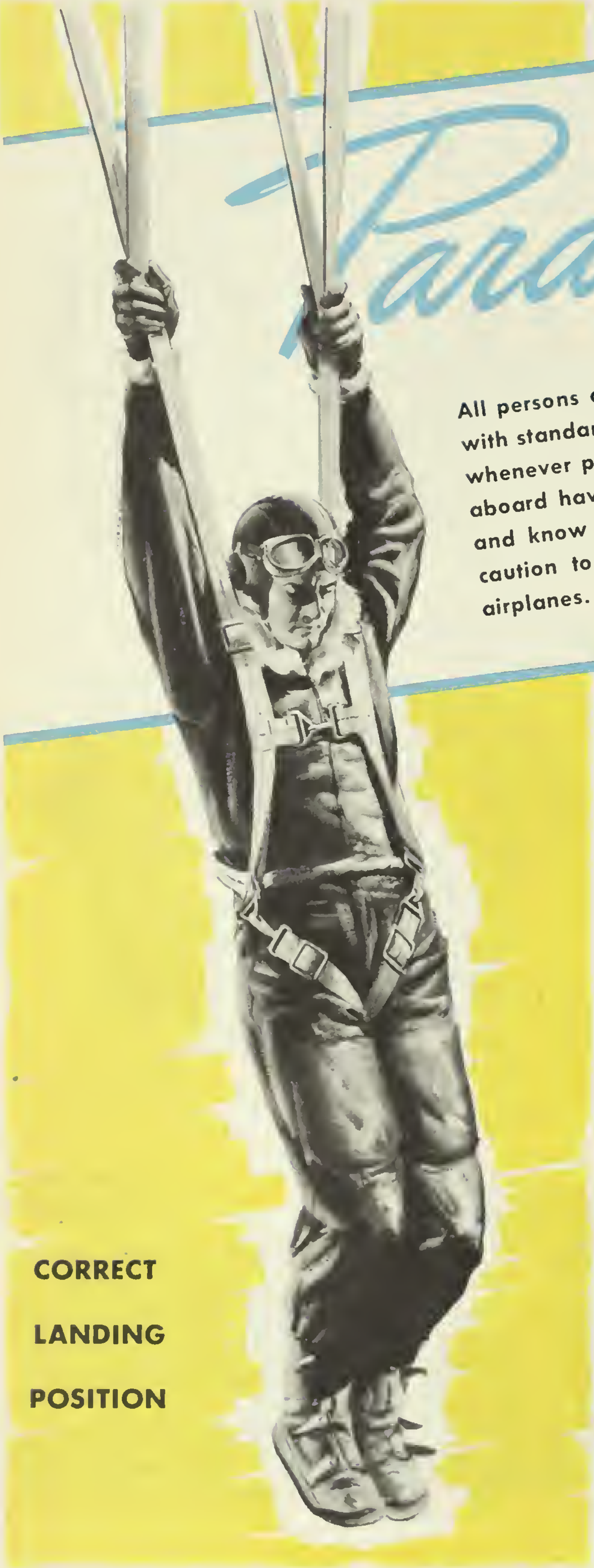
Leave radio on Mayday channel. Get continuous transmission by switching the toggle switch on the radio control box to "T." Transmission continues until the airplane crashes. Do this only as the last resort before you bail out.

Wingmen or flight members, on hearing your call on operations channel, should if possible orbit the spot, one ship going down low, the other remaining high and continuing transmission of distress signals. This insures that a good fix is obtained.



Parachutes

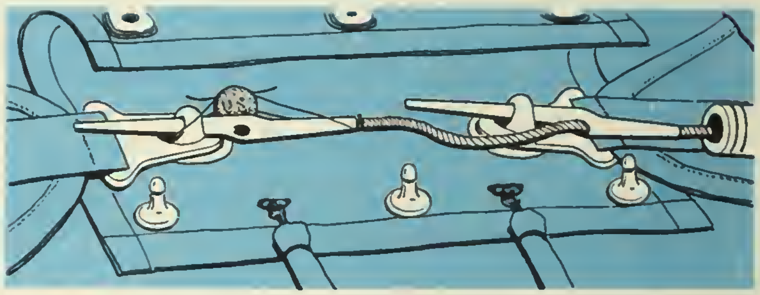
All persons aboard Army airplanes will be equipped with standard-type parachutes. Wear your parachute whenever possible. The pilot will see that all persons aboard have parachutes, are instructed in their use, and know the bail-out plan. It is an excellent precaution to carry an extra parachute in multiplace airplanes.



CORRECT

LANDING

POSITION



BEFORE THE FLIGHT

Inspect your parachute. Remember, you may have to jump with it! Check the date of the last inspection. The packing interval should not exceed 60 days in the United States or 30 days in the tropics. Open the flap; make sure that the ripcord pins are not bent and that the seal is not broken. A bent pin or jammed wire may make it impossible to pull the ripcord. See that the corners of the pack are neatly stowed so that none of the silk is visible. See that the six or eight opening elastics are tight. Inspect each parachute you draw.

Put your parachute on and be sure the harness fits properly. The shoulder and chest straps should be snug without play; the chest buckle should be twelve inches below the chin. The leg straps should be snug. In fact, the harness should be comfortably snug when you are seated and disagreeably tight when you stand up.

IN FLIGHT

If you find yourself in serious trouble, prepare to put your bail-out plan in operation. The plan will depend to some extent on whether you are alone or carrying a crew.

If you are alone:

1. Note your altimeter reading.
2. Estimate the altitude of the terrain below.
3. Decide on a minimum altitude or altimeter reading at which you can safely bail out, taking into consideration the flight characteristics of the plane and the kind of trouble you are having.
4. If you are still in trouble when you reach that minimum altitude—bail out.

With a crew, consider these additional points:

5. Remember that in general it is safer to jump your crew than to attempt a forced landing on hazardous terrain with a fully loaded plane.
6. Whenever there is serious question about a safe landing, warn your men that they may have to jump. Get them ready. If the situation improves, so much the better.
7. If the situation does not improve, pick the best available spot, slow the plane, and bail them out.
8. If necessary, bail out yourself. Whenever possible, set the automatic pilot to take the abandoned airplane away from inhabited areas in a prompt descent.

THE BAIL-OUT

Every pilot should know the emergency exits provided for the airplane he commands and should see to it that his crew knows them and understands how and when to use them. Bail-out posters are supplied for most bombardment types and are now being prepared for other aircraft.

Practice making exits while wearing full equipment when the airplane is on the ground. It is the direct responsibility of the pilot to drill his crew in a standard bail-out procedure, including warning signals and exit signals.

DRILL IS ESSENTIAL

Each crew member must know when, where, and how he is to leave the airplane.

Jumping from Single-Engine Trainers and Fighters

1. Dump the cockpit canopy, or open the emergency exit, or pull the side window as low as possible.
2. Slow the airplane as much as possible.
3. Disconnect your radio headset, etc.
4. Release safety belt and shoulder harness.
5. Dive out and down. Often you can go out flat, onto the wing, and slide head first off the trailing edge.

In certain types of fighters it is sometimes desirable to turn the airplane upside down:

1. Dump the canopy.
2. Invert your plane.
3. Disconnect equipment.
4. Release safety belt and shoulder harness and dive straight down.

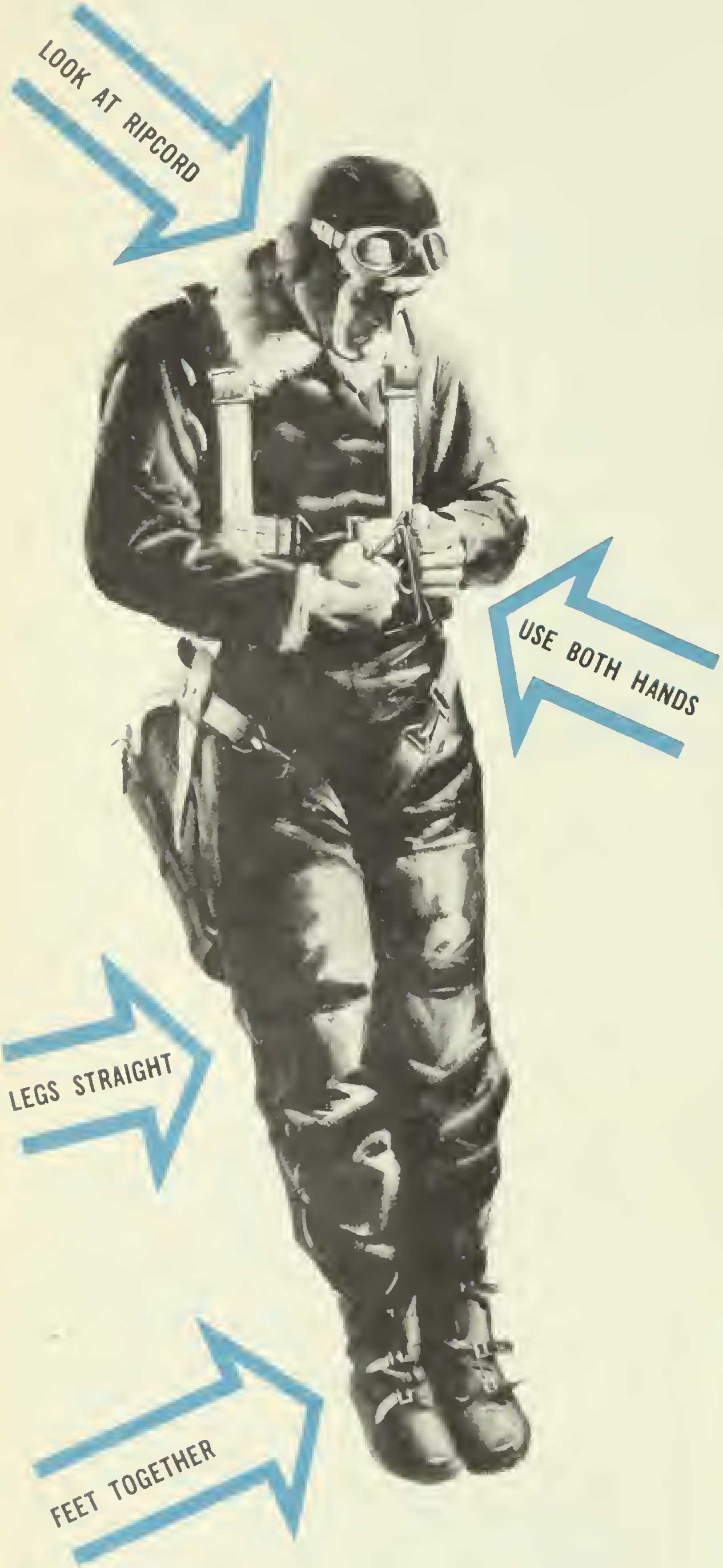
Jumping from Twin-Engine Trainers, Bombers, and Transports

You will normally use an escape hatch, the bomb bay, or a door, depending upon circumstances. Slide yourself to the edge of the opening and go out head first and straight down.

CLEARING THE AIRPLANE

Probably the most important single act, in any parachute jump, is opening the parachute only **after you are clear of the plane. Wait** until you are well away from the airplane before you pull the ripcord. Keep your eyes open. Look around. If you have enough altitude, wait at least five to ten seconds before pulling the ripcord.

PULLING THE RIPCORD



There is nothing complicated or difficult about getting your parachute safely open. Just:

1. Straighten your legs and put your feet together to reduce the opening shock, and to avoid tangling your harness.
2. Use both hands to grasp the ripcord pocket.
3. Grab the ripcord handle with the right hand, and yank! Keep your eyes open and look at the ripcord as you pull it.

THE DESCENT

About two seconds after you have pulled the ripcord, you will feel a sharp, strong tug as the canopy opens and bites the air.

Look up to see that the chute is fully open. If a suspension line traverses the top, or the lines are twisted, manipulate the lines to remedy the fault.

Do not worry about oscillations. They will almost certainly occur on your way down, but are of minor consequence. Do not attempt to check them or to slip the parachute, as such maneuvers are useful only to experts, and are dangerous below 200 feet.

Make a quick estimate of your altitude by looking first at the ground below and then at the horizon.

You will descend approximately 1000 feet per minute.

Observe your drift by craning your neck forward and sighting the ground between your feet, keeping your feet parallel and using them as a driftmeter.

Face in the direction of your drift.

While you cannot steer your chute, you can turn your body in any desired direction. **The body turn is the most useful maneuver you can learn because with it you can make certain that you land facing in the direction of your drift. It is simple and easy. Note carefully exactly how it is done.**

STUDY THE PICTURES. Practice the body turn in a suspended harness if you get the chance. This description may sound backward to you. Note with special care how these turns are executed and simply say to yourself:

"To turn right, right hand behind my head."

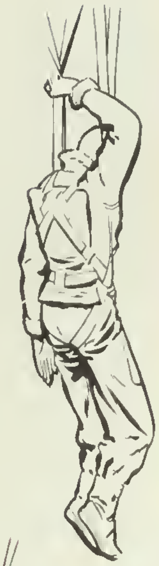
"To turn left, left hand behind my head."

HOW TO MAKE BODY TURNS

TO TURN YOUR BODY TO THE RIGHT:

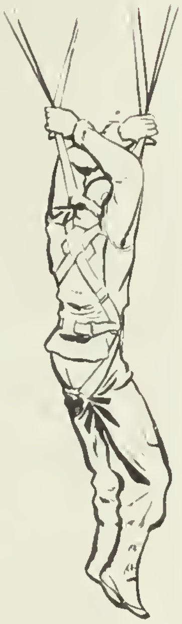
1

Reach up behind your head with your right hand and grasp the left risers.



2

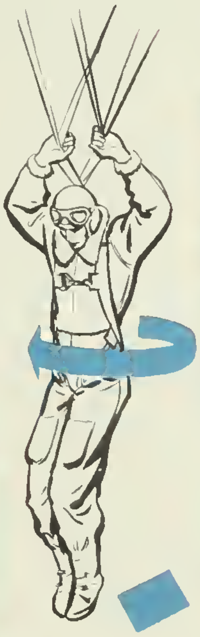
Reach across in front of your head with your left hand and grasp the other risers. Your hands are now crossed, the right hand behind, and in each you have two risers.

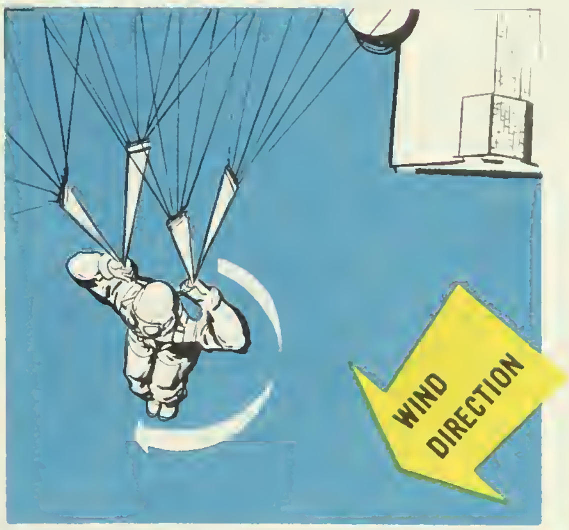


3

Pull simultaneously with both hands; this will cross the risers above your head and turn your body to the right. You can readily turn 45°, 90°, or 180° by varying the pull.

To turn to the left, reverse this procedure.





In the descent, start your body turn high enough to allow you to master it. Once you have made the turn, you will find that you can control your direction of drift perfectly. Hold the turn, or slowly ease up if necessary, to bring you in facing downwind. Continue to hold the risers, whether you have had to twist them to make a body turn or not, and ride right on into the ground this way.

THE LANDING

NORMAL LANDINGS

Whether you have made a body turn or not, keep your hands above your head, grasping the risers.

Look at the ground at a 45-degree angle, not straight down.

Set yourself for the landing by placing your feet together and slightly bending your knees, so that you will land on the balls of your feet.

Don't be limp; don't be rigid.

Relax, and keep your feet firmly together with your knees slightly bent, and your hands grasping the risers above. Now hold everything and ride on into the ground, drifting face forward.

At the moment of impact, fall forward or sideways in a tumbling roll to take up the shock.

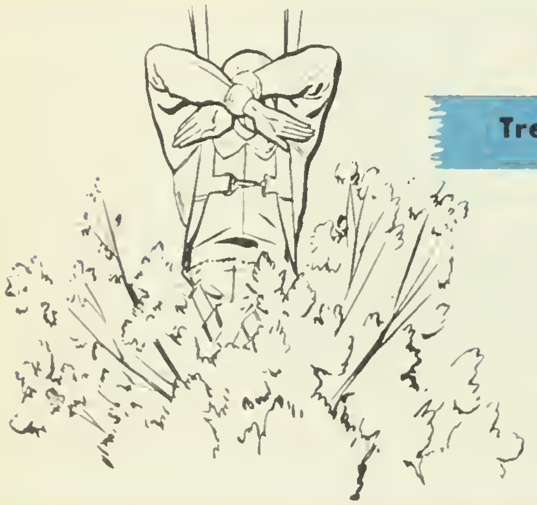
ABNORMAL LANDINGS

High Wind

If there is a strong wind blowing across the ground when you land, do two things.

First, make certain that you carry out the procedures described above for a normal landing, **including the body turn to face you exactly in your direction of drift.**

Second, once you are down, roll over on your abdomen and haul in hand over hand on the suspension lines nearest the ground. Keep right on pulling them in until you grab silk. Then, drag in the skirt of the canopy to spill the air and collapse the chute. If you can't manage this maneuver on your face, go over onto your back, but haul in the suspension lines until you have got the bottom edge of the canopy, then spill the chute.



Trees

Tree landings are usually the easiest of all. If you see that you are going to come into a tree, drop the risers, cross your arms in front of your head, and bury your face in the crook of an elbow. You can see under your folded forearm. Keep your feet and knees together. If you get hung up high in a tree, consider first the possibility of immediate rescue before you try to climb down. Failing that, get out of the harness and cut the lines and risers to make a rope for climbing down.

Water

Water landings are safe if you know what to do. The ability to swim is an advantage but not a prerequisite if you are properly equipped and trained. Follow the procedure outlined here for all types of parachutes except the QAC AN6513-1A (which has no risers on pack or harness) and the single point quick release, instructions for which are given separately. Prepare for the water landing as soon as the parachute is open.

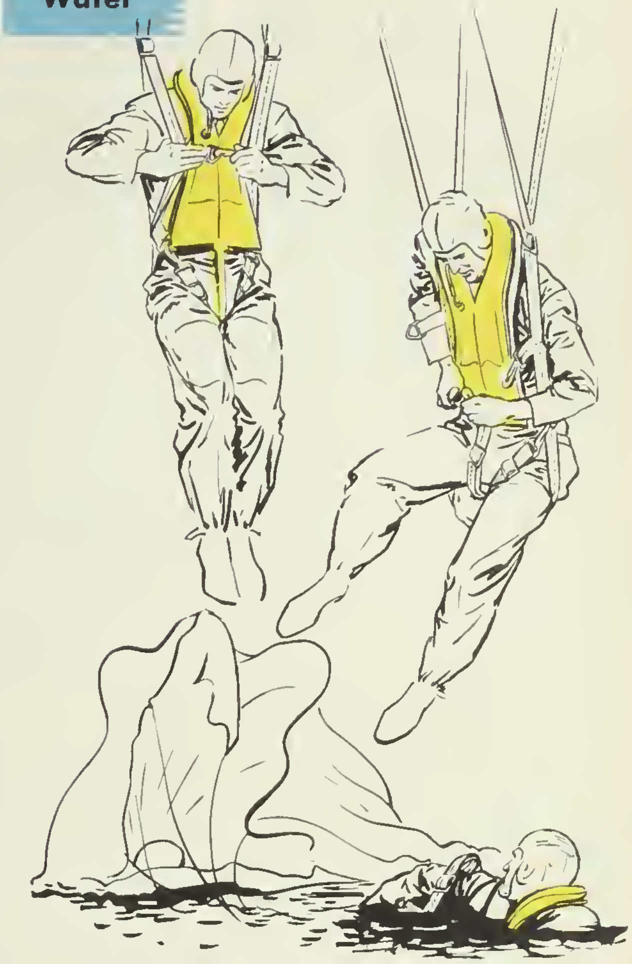
1. Throw away what you won't need.
2. Pull yourself well back in the sling by hooking your thumbs in the webbing and forcing the sling downward along your thighs.
3. Undo your chest strap by hooking a thumb beneath one of the vertical lift webs, pushing firmly across your chest to loosen the cross webbing so that you can undo the snap. **This must be done before you inflate the Mae West, as the chest strap cannot be released over an inflated life vest.**
4. When chest strap is undone and you are well back in the sling, unsnap the leg straps by doubling up first one leg and then the other. Then keep your arms folded, or hang onto the risers, so you won't fall out of the harness. If you are unable to unfasten leg straps in the air, remove them in the water by unsnapping them or by working them down over your feet.
5. As soon as you are in the water, inflate your Mae West, one half at a time (either half will support you) and shrug out of the harness. **Remember, never inflate your life vest until you have unfastened your chest strap.**
6. Get clear of the parachute promptly, and stay clear.

Procedure for QAC AN6513-1A (no risers on pack or harness)

Modify the standard procedure as follows:

1. Reach under the pack cover and unfasten the chest strap.

2. Pull yourself well back in the sling and undo the leg straps, if you have time.
3. As soon as you are in the water, release both sides of chest pack from harness and immediately swim **upwind**, away from the canopy and lines.
4. Inflate the Mae West, one half at a time, but never until the chest strap is unfastened.
5. When clear of the canopy and shroud lines, you can slip out of your harness at leisure.



Procedure for Single Point Quick Release Harness

Modify the standard procedure as follows:

1. Before reaching the water, turn the locking cap 90° to set the release mechanism for immediate operation.
2. As soon as you are in the water, but not before, pull the safety clip, and press hard on the cap to release the lock. The harness will then slide off.
3. Inflate the Mae West, one half at a time, but never until the harness has been released.
4. Stay clear of the parachute.

See Life Vest, PIF 8-10-2 and Life Rafts, PIF 8-11-3.

WARNING: The canopy and shroud lines, **not the harness**, may dangerously tangle you after landing in water. When equipped with any quick attachable chest pack, first unsnap the entire pack from the harness, then get away from the canopy and lines before you stop to take off the harness. **Think it through now and you'll be safe later.**

On over-water flights, always carry a sharp, serviceable knife where it is easily accessible. If you experience difficulty releasing yourself from the harness after landing in water, stay calm and cut yourself free.

NIGHT JUMPS

As soon as you are in the chute, prepare for a normal landing. Since you cannot see the ground on a dark night, you want to be ready to make contact at any moment. **Get your feet and knees together, your legs slightly bent. Hang onto the risers above your head and wait for contact.**

HIGH ALTITUDE JUMPS

Bail-outs from high altitudes present special problems. The higher the altitude, the greater the dangers in bailing out. Stay with the airplane as long as you safely can; down to 15,000 feet if possible. If you must leave the airplane at altitudes above 15,000 feet and if you do not have bail-out oxygen equipment, take a deep breath of pure oxygen and hold your breath. Dive out and continue to hold your breath as long as you can before pulling the ripcord.

Except in extreme emergency, do not attempt a bail-out without bail-out oxygen equipment above 30,000 feet.

The chief hazards of high altitude jumping are:

1. Intense cold.
2. Lack of oxygen.
3. High G forces induced by the parachute opening at high altitudes.

If it is necessary to bail out at high altitude, you can reduce the hazard by making a long free fall to about 10,000 feet before pulling your ripcord. A free fall enables you to reach warmer regions more rapidly; it reduces the hazard of anoxia, and insures less shock when the parachute opens.

At high altitudes the opening shock of the parachute develops excessive G forces. The higher the altitude, the greater the shock.

Judging Altitude in Free Falls

Do not depend upon counting or timing to judge distance above the ground. In the excitement it is difficult if not impossible to judge time.

Look at the ground and judge your altitude. For instance, at 5,000 feet the earth begins to look green, you can distinguish details, the horizon spreads, and the ground rushes up at you.

Changing Your Falling Attitude

If your falling attitude is such that you can't see the ground, you can alter your position by extending an arm and the resulting turn will give you a look at the ground. Then pull in your arm and legs and straighten out your knees to stop tumbling before you pull the ripcord.

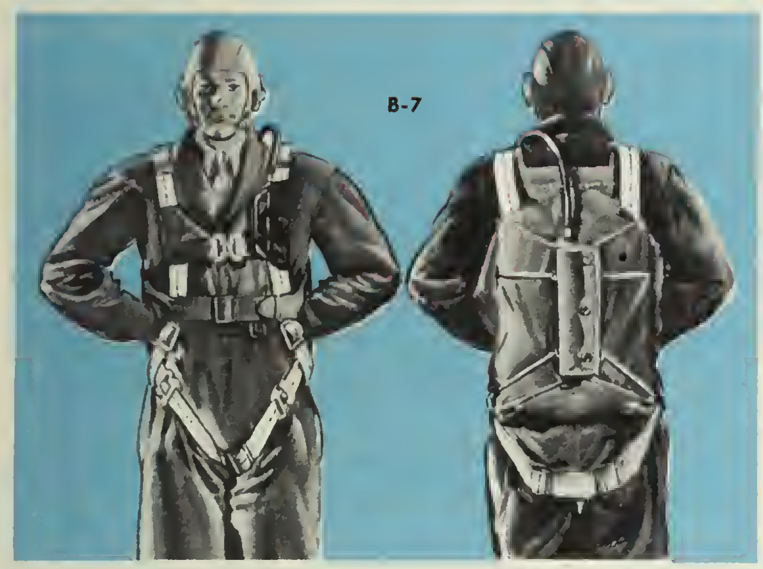
Terminal Speed

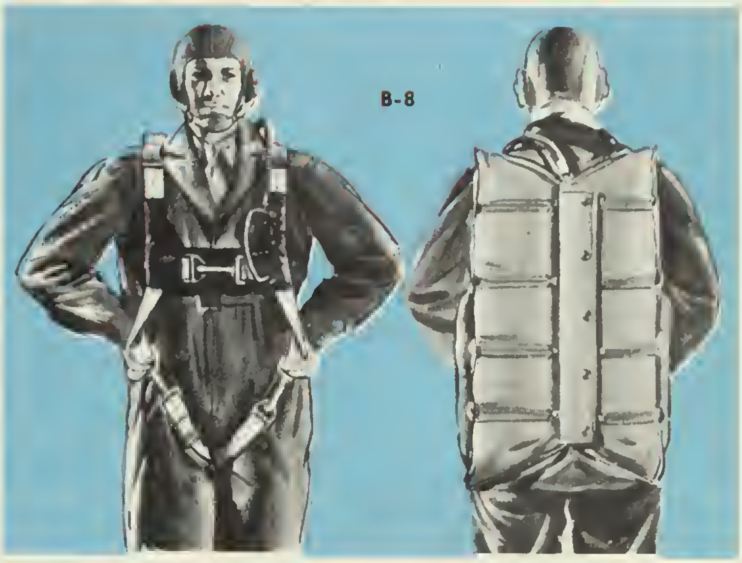
Remember that in many emergency jumps you may leave the airplane at speeds so high that an immediate parachute opening would be dangerous. Hence, if you have sufficient altitude, you should wait 5 to 15 seconds to slow down before pulling the ripcord. This will avoid injury to yourself or damage to your parachute. You actually slow down during the first 10 to 15 seconds in a free fall until you reach terminal velocity. The lower the altitude, the lower the terminal velocity. So in making a free fall you do not tend to fall faster the longer you fall. You actually fall slower and slower the lower you get because the air becomes denser. With your parachute open, the rate of descent is also slower the lower you get.

Notice

In all jumps from above 10,000 feet, fall free to 10,000 feet or less before pulling the ripcord if you can. This will reduce your exposure to cold, anoxia, enemy action, and lessen the opening shock of the parachute. If you do not have bail-out oxygen equipment, just hold your breath and dive out. Then continue to hold your breath as long as possible before pulling the ripcord.

Parachute Types



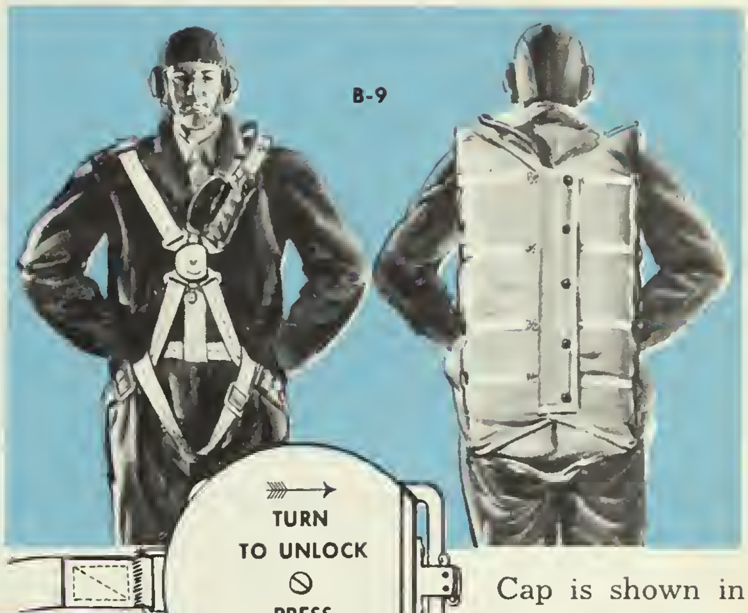


BACK-TYPE PARACHUTES

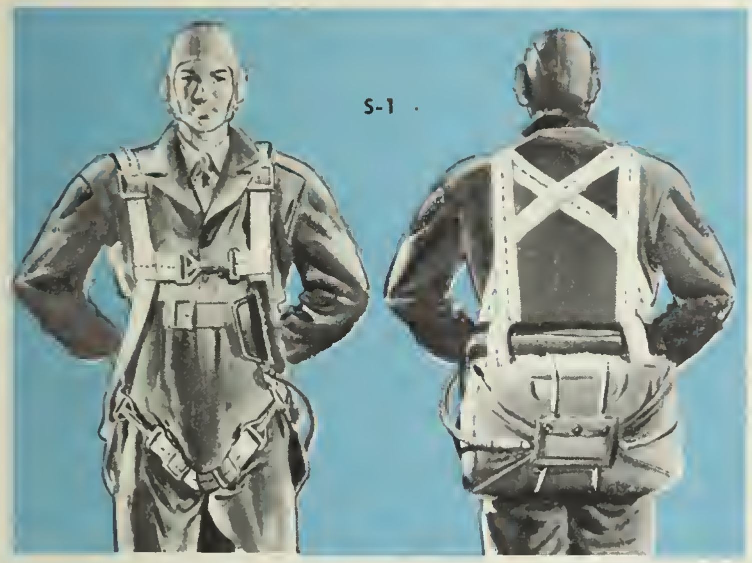
Type B-7 (AN6512). The chest straps and leg straps have bayonet type or snap fasteners. Note that parachute belt is worn outside harness to hold webbing snug.

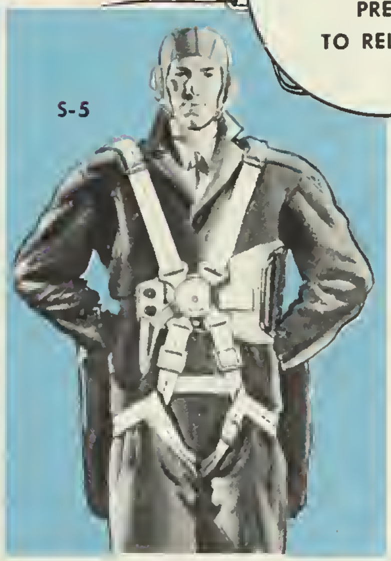
Type B-8. Flexible back pack with bayonet type fasteners on chest and leg straps. Older type B-8 parachutes have snap fasteners.

Type B-9. Flexible back pack on single point Quick Release harness. To get out of Quick Release harness turn the cap clockwise 90°, pull safety clip, and strike the cap a sharp blow with the hand.



Cap is shown in safetied position.





SEAT-TYPE PARACHUTES

Type S-1, S-2, AN6510, and AN6511. Harness has back and seat pad. Chest and leg straps have snap or bayonet fasteners.

Type S-5. Same chute as S-1 with single point Quick Release harness.

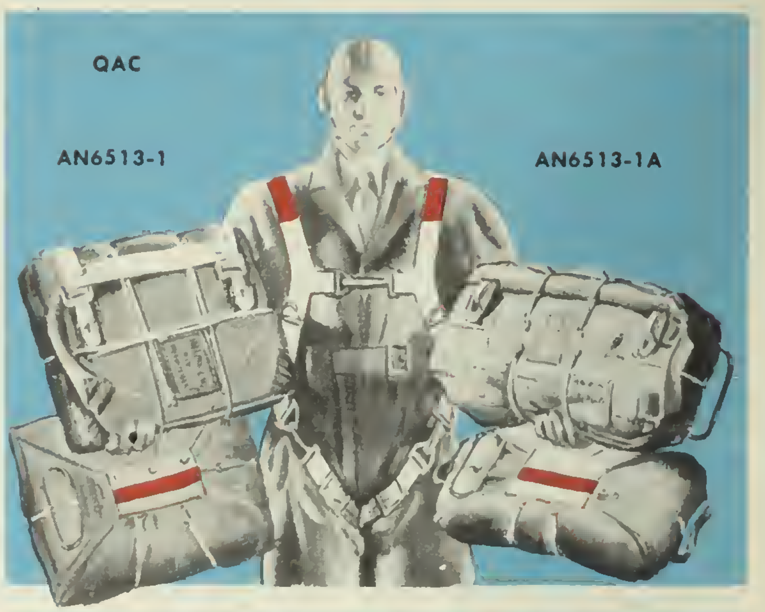
ATTACHABLE CHEST-TYPE PARACHUTES

Group 1 Assemblies

Type QAC (AN6513-1). Quick attachable chest-type parachute with square pack. Harness has snap fasteners on chest and leg straps. It has D-rings for attachment of pack.

Type QAC (AN6513-1A). Quick attachable chest-type parachute with barrel-type pack. Harness has snap fasteners on chest and leg straps. It has D-rings for attachment of pack.

Note: **On both AN6513-1 and AN6513-1A parachute assemblies the snaps are on the pack and the D-rings are on the harness.** Either of these packs can be used with the harness shown.

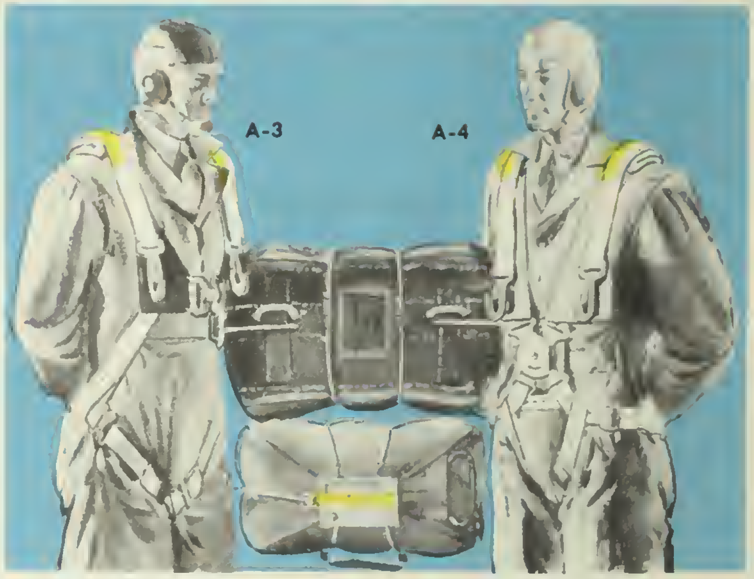


Group 2 Assemblies

Type A-3. Quick attachable chest-type parachute with barrel type pack. Harness has bayonet type fasteners.

Type A-4. Quick attachable chest-type parachute with barrel-type pack and single point Quick Release harness.

Note: **On the A-3 and A-4 parachute assemblies the rings are on the pack and the snaps are on the harness.** This pack can be used with either of the harnesses shown.



Caution!

Parachutes in Group 1 are not interchangeable with parachutes in Group 2.

Each pilot is responsible for the prevention of mismatching quick attachable parachutes in his airplane.

Before taxiing for takeoff the pilot should:

1. Inspect all attachable parachutes to see if the pack will fit the harness. Snap each pack to its harness to make certain.
2. Inspect all attachable parachute assemblies (packs and harnesses) in the airplane and make certain that all are in Group 1 or that all are in Group 2.

This will prevent danger of mismatching.

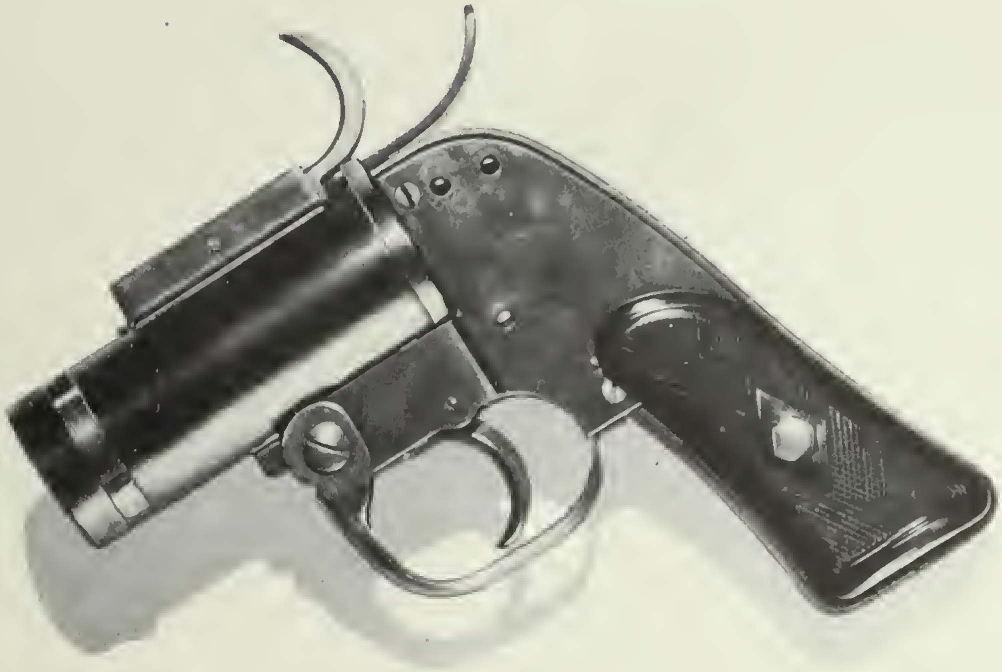
Group 1 parachutes and harnesses are marked with red webbing.

Group 2 parachutes and harnesses are marked with yellow webbing.

Make sure all packs and harnesses in your plane are the same color.

REFERENCE: Technical Order 13-5-39

PYROTECHNIC PISTOLS



When radio communication is inadvisable or when radio equipment has failed, brief coded messages may be sent with pyrotechnic signals. Do not use pyrotechnic signals to control important operations unless no other means is available. The various colored signals which are available for use with M2 and AN-M8 pyrotechnic pistols are assigned different meanings under a code that will be changed at frequent intervals in each edition of Signal Operation Instructions. The M11, red star parachute signal, however, is always used as a distress signal to be fired from the ground or from a life raft.

M2 Pistol

The M2 pyrotechnic pistol has a strong recoil. Use both hands to fire it if practicable. The signals themselves burn with an extremely hot flame; observe every reasonable precaution while handling or firing them.

1. **Fire signals only from airplane in flight** with the exception of the M11 distress signal.
2. Point the pistol in such a way as to prevent signals from striking any part of the airplane.
3. If a signal fails to ignite on the first attempt, try at least twice more. **If third or final try fails, keep the pistol pointed overboard and clear of all parts of the airplane for at least 30 seconds, then discard signal.**
4. **Discard a misfired signal, if possible, without handling the signal itself.** One method is to hold the pistol over an opening in the airplane and release the cartridge by pressing on the latch and allowing the signal to fall clear under the force of gravity. The force of the air blast prevents holding the pistol on the outside of most airplanes. **Be careful to prevent discarded signal from striking any part of the airplane.**
5. Do not discard misfired signals when flying over populated areas.
6. Fire the M11 distress signal as nearly straight up as is practicable.

AN-M8 Pistol

The AN-M8 pyrotechnic pistol is replacing the M2 pistol. It is fired by inserting and locking the barrel in a type M-1 mount. This mount is really a little "door," fastened rigidly to the airplane, that permits the pistol barrel to extend through the airplane outer skin. The mount absorbs the recoil of the pistol. Observe these precautions in using this pistol:

1. Place cartridge in chamber after pistol is inserted in mount, and only when immediate use is anticipated.
2. Since the pistol is cocked at all times when the breech is closed, **never leave a live signal in the pistol when it is removed from the mount.**

SMOKE GRENADES

Airplanes to be flown over sparsely settled regions on cross-country, patrol, or ferry missions will be equipped with either an M8 or an M3 smoke grenade. In the event of a forced landing, use the grenade as a marker to aid searching parties in locating the airplane which otherwise might be difficult to find.

Pilots observing smoke of the type produced by M8 or M3 smoke grenades will immediately attempt to locate the source.

The M8 smoke grenade burns about 3½ minutes, giving off a dense **gray** smoke, and is intended to be used primarily in heavily forested regions. It is easily distinguished from wood fires which give off a blue-gray or black smoke.

The M3 smoke grenade is designed to be used in snow-covered regions. It gives off a dense **red** smoke for 2 minutes which can be distinguished against a white snow background for about 4 miles by a person in an airplane.

Method of Firing M8 Smoke Grenade

1. Grasp the grenade with lever held firmly against grenade body.
2. Withdraw safety pin, keeping a firm grip around the grenade and lever.
3. Either throw the grenade with a full swing of the arm, or place on the ground and release.
4. As the grenade is released from the hand, the lever drops away, allowing the striker to fire the primer.

Method of Firing M3 Smoke Grenade

1. Pull the 3 vanes on the side of the grenade up and away from grenade body.
2. Place grenade in snow so that it is supported by the vanes in an upright position.
3. Keep lever held firmly against grenade and withdraw safety pin.
4. Release lever.

Safety Precautions

To avoid a fire, do not throw or place the grenade within 5 feet of dry grass or other readily inflammable material.

After the grenade is ignited, **stay at least 5 feet away from the burning grenade**, as heavy smoke develops and there is a tendency to throw off hot particles of residue.

Keep these smoke grenades dry. If the chemical contents of a grenade become wet, it will ignite. Future procurement of these grenades for the Army Air Forces will be packed in individual waterproof containers.

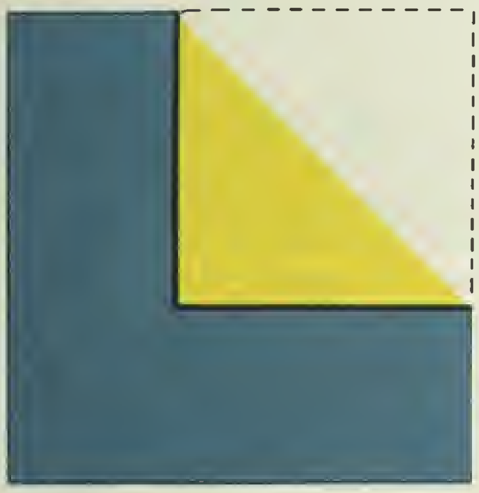
All smoke grenades will be shipped and handled in accordance with Interstate Commerce regulations. These regulations prohibit the shipment of these smoke grenades in personal baggage.

REFERENCE: T. O. 01-1-38, dated April 14, 1942

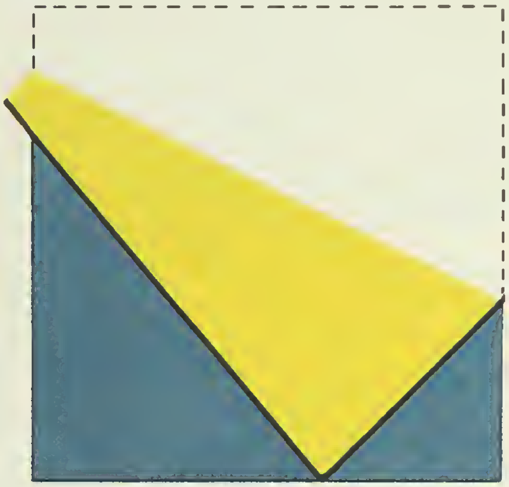
Panel Signals

Many of the emergency kits now supplied contain a large signal panel (roughly 10 ft. by 10 ft.). It is are fluorescent yellow on one side and blue on the other. Immediately after you are forced down this panel should be spread out on the ground flat—yellow side up on dark backgrounds and blue side up on light backgrounds—the color will help rescue pilots to find you. Once a rescue pilot has located you, messages can be transmitted by folding the panel as indicated in the illustrations on these pages. If it is windy, hold the folds in place with rocks, sand, sticks, or improvised stakes if it is necessary. If several messages are to be transmitted don't change the folds too quickly—allow enough time for the pilot of the rescue plane to read each signal and indicate that he understands it (generally by dipping the nose of his plane several times). These same signals can be transmitted with the square yellow-and-blue sail now a part of the equipment supplied with the large inflatable rubber life raft.

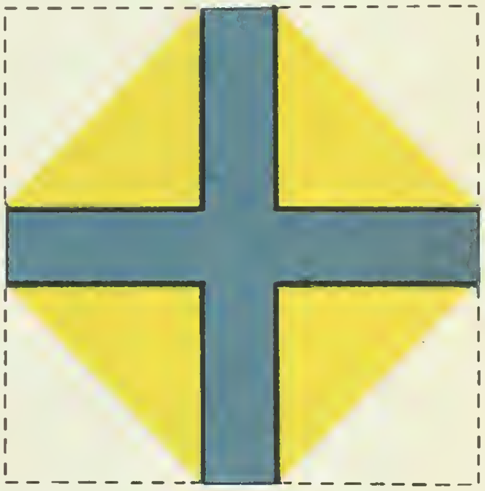
The emergency signal panel also can be used as a tent since its blue side is coated with a waterproof compound. Also, the blue side can be used as an excellent camouflage cover for a life raft if enemy aircraft are sighted.



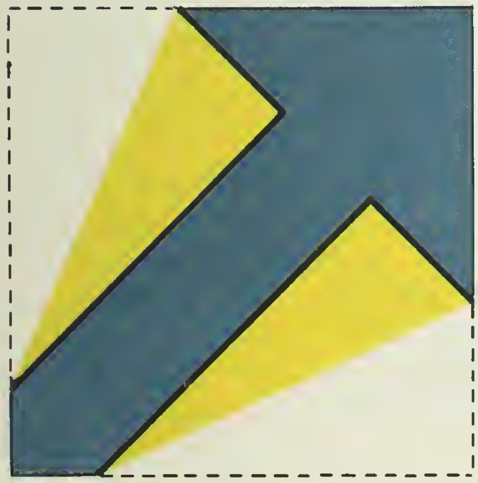
Need Gasoline and Oil, Plane is Flyable



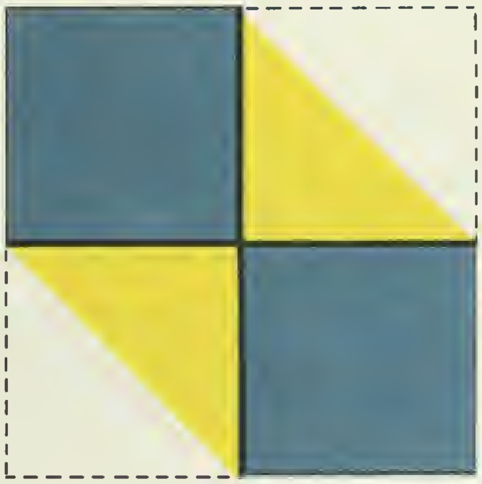
Need Tools, Plane is Flyable



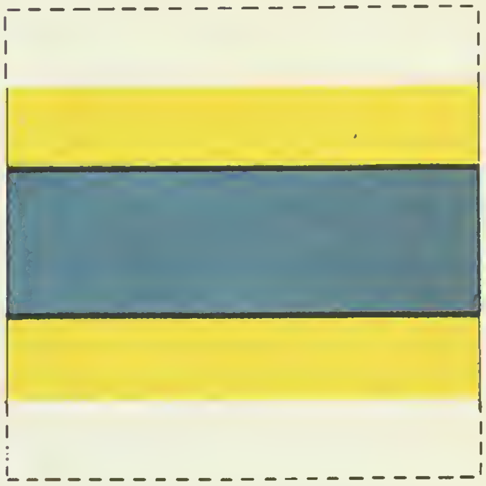
Need Medical Attention



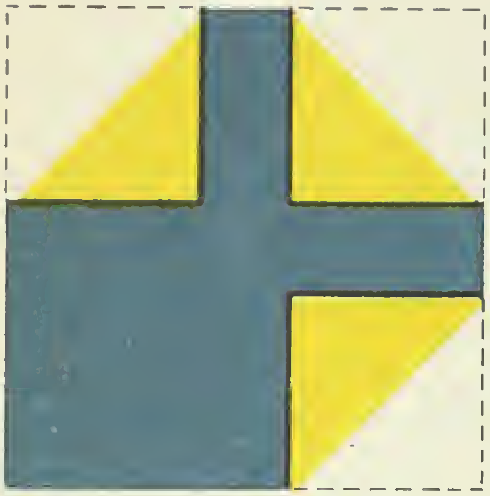
OK to Land, Arrow Shows Landing Direction



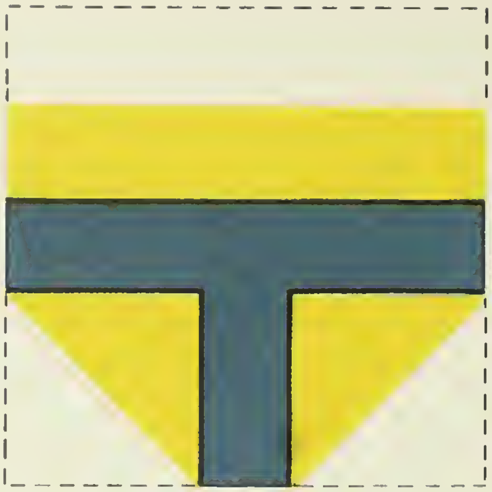
Do Not Attempt Landing



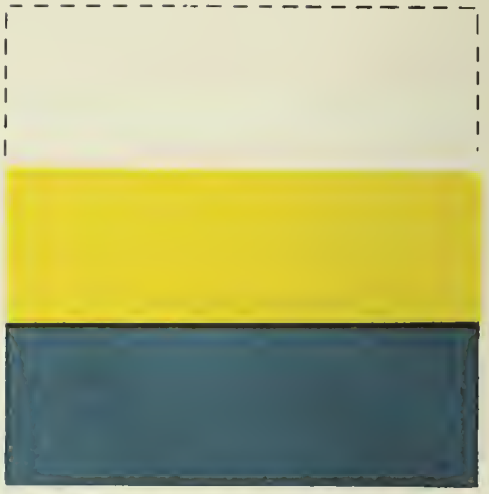
Indicate Direction of Nearest Civilization



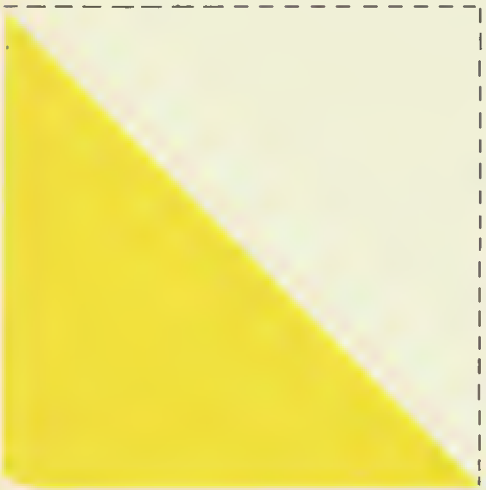
Need First-Aid Supplies



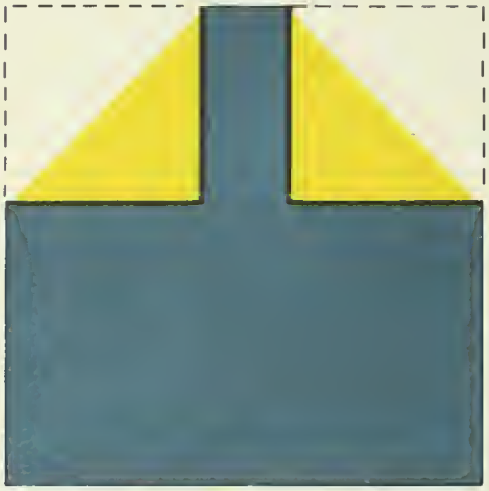
Need Quinine or Atabrine



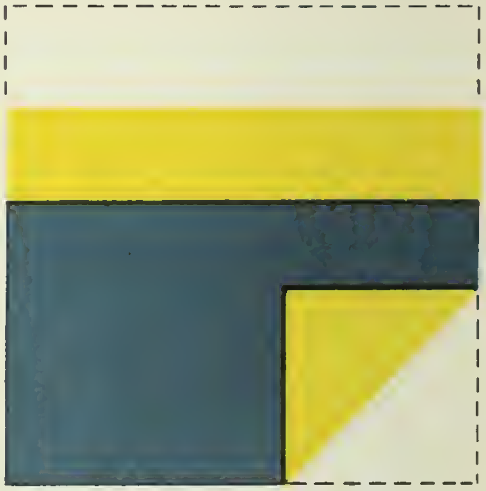
Should We Wait For Rescue Plane?



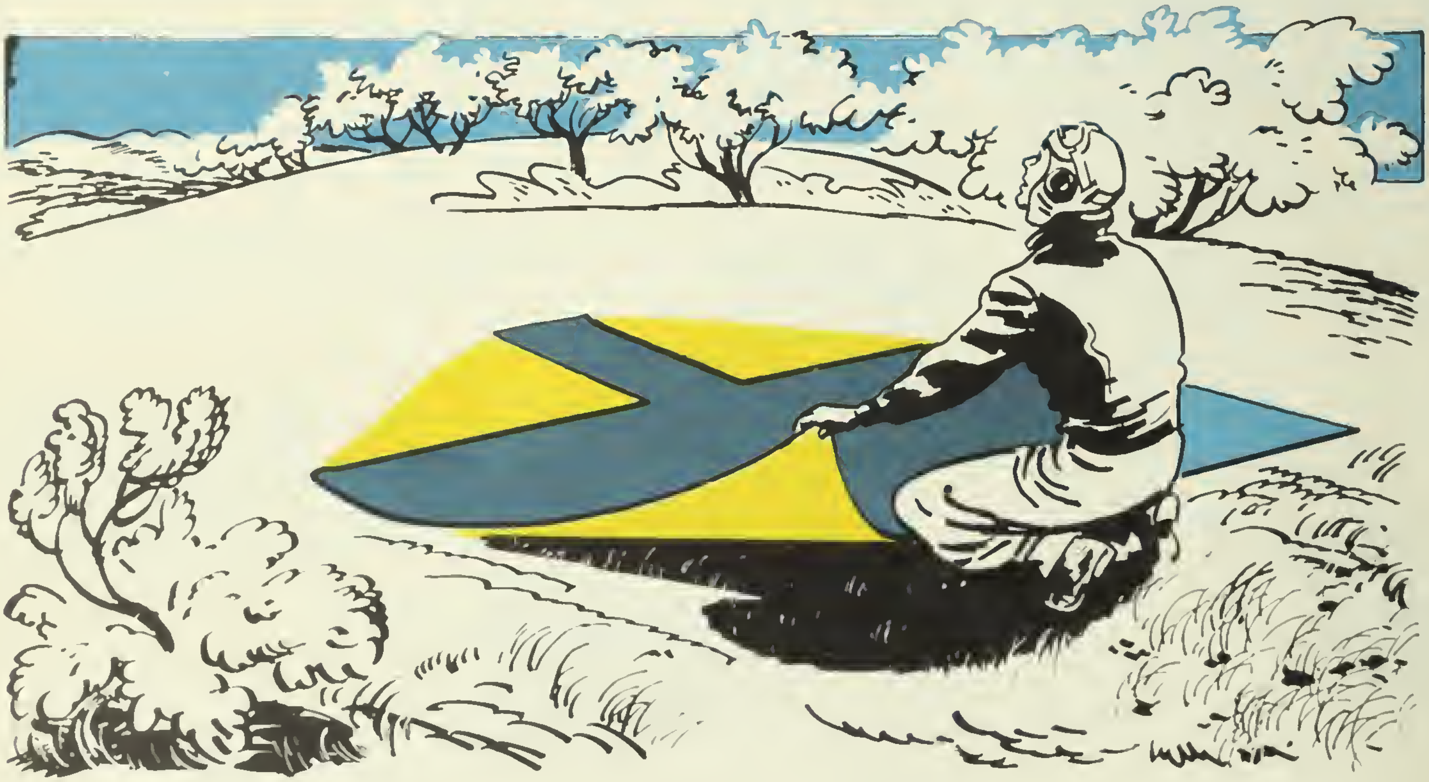
Need Food and Water



Need Warm Clothing

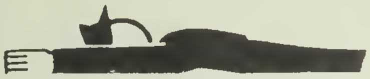


Have Abandoned Plane, Walking in This Direction ➡

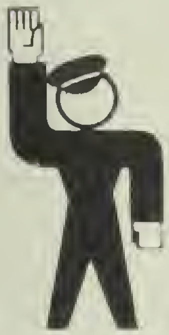


Body Signals

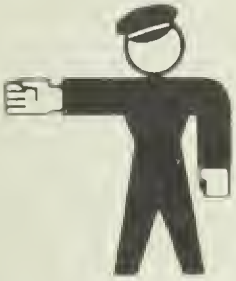
If a rescue plane flies low and circles your location and you are sure that you have attracted the pilot's attention, messages can be transmitted by the emergency body signals shown on this page. When performing the signals stand in the open, make sure that the background as it will be seen from the plane is not confusing, make the motions deliberately and slowly, and repeat each signal until the pilot indicates that he understands.



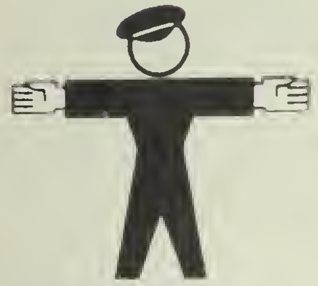
NEED MEDICAL ASSISTANCE—URGENT (Lie prone)



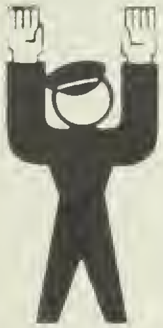
ALL O K
DO NOT WAIT



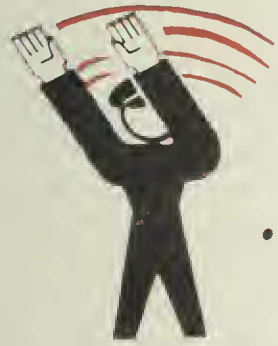
CAN PROCEED SHORTLY—
WAIT IF PRACTICABLE



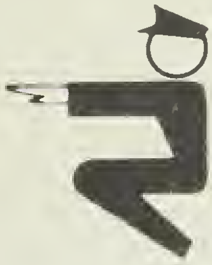
NEED MECHANICAL HELP
OR PARTS—LONG DELAY



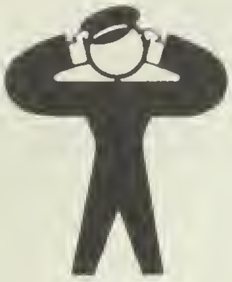
PICK US UP—
PLANE ABANDONED



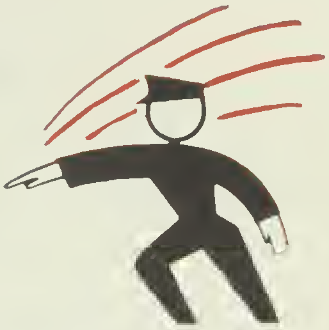
DO NOT ATTEMPT
TO LAND HERE



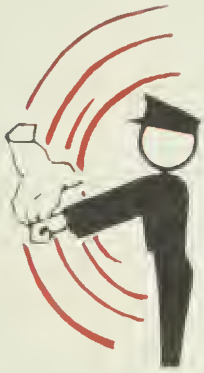
LAND HERE (Point in
Direction of Landing)



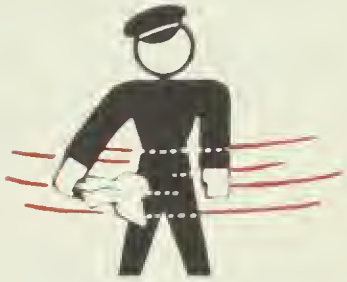
OUR RECEIVER
IS OPERATING



USE DROP
MESSAGE



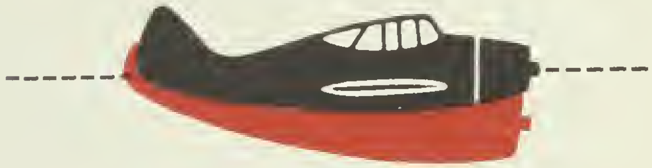
AFFIRMATIVE (Yes)



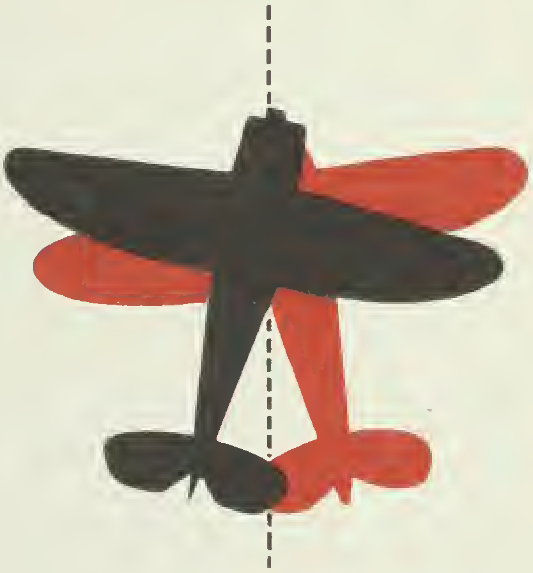
NEGATIVE (No)

HOW PLANE ANSWERS

The pilot of the rescue plane will answer your messages either by dropping a note or by dipping the nose of his plane for the affirmative (yes) and fishtailing his plane for the negative (no).



AFFIRMATIVE (Yes) DIP NOSE OF PLANE



NEGATIVE (No) FISHTAIL PLANE

VEST TYPE EMERGENCY KIT

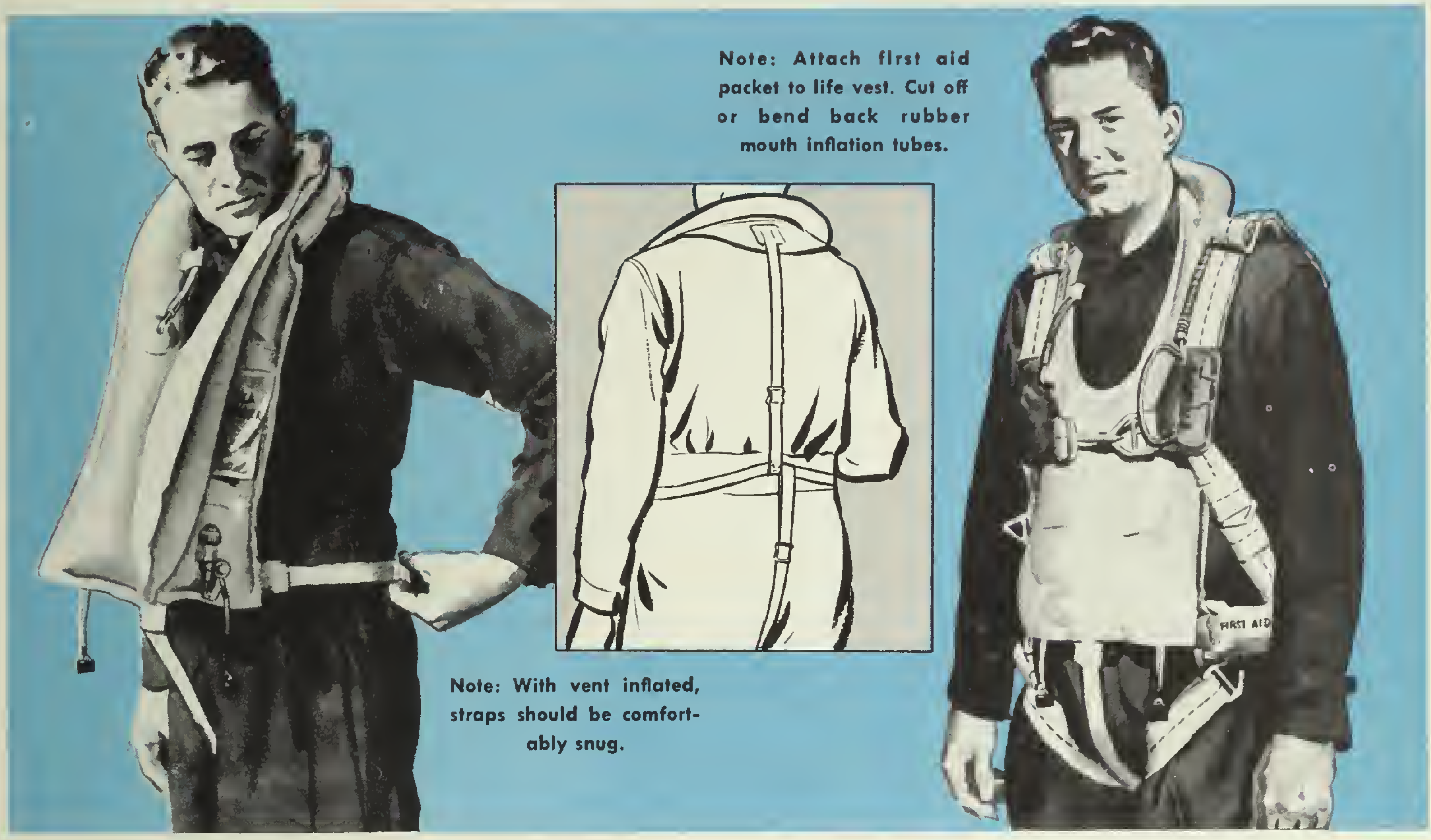
Vest, Emergency Sustenance, Type C-1 was developed for the use of pilots and crew members forced down in isolated regions. It consists of an adjustable vest-like garment, fitted with pockets into which the items of the kit are conveniently stowed. The vest is to be worn under the life preserver vest and parachute.

PROTECT YOURSELF Before taking off on a flight over inaccessible or mountainous country, the arctic, jungle, desert, or ocean, check your vest and be sure it contains all the necessary equipment. If it does not, check with your Personal Equipment Officer.

The following items of equipment are carried in the pockets of the vest:

1	hat (yellow on one side, OD on the other)
1	pair polaroid sun goggles
1	signal mirror, with lanyard
1	sharpening stone
1	fishing-sewing kit, in plastic container
1	collapsible spit and gaff
1	plastic water canteen (3-pint capacity)
1	Boy Scout knife
1	large knife (with 5-inch saw and blade)
1	package toilet tissue
10	yds bandage (with sulfa powder)
1	waterproof match-box with compass
20	matches
14	fire starting tabs
1	burning glass
1	signal whistle
1	oil container
1	waterproof cover for .45 cal. pistol
20	.45 cal. shot cartridges
1	First Aid Kit
1	Survival manual
2	vest-kit rations in tin containers
2	five-minute signal flares
1	mosquito headnet
1	collapsible container for boiling water
1	pair woolen insert gloves
1	pair leather outer gloves

LIFE PRESERVER VEST



Note: Attach first aid packet to life vest. Cut off or bend back rubber mouth inflation tubes.

Note: With vent inflated, straps should be comfortably snug.

Wear your life vest whenever you fly over water.

When the vest is issued to you, put it on, inflate it by the mouth tubes. Adjust the straps. **With the vest inflated the waist strap should be tight, the crotch and back straps snug. After adjusting the back strap hand tack it to the waist strap.** Deflate the vest by opening the valves at the base of the mouth tubes. Roll the vest up to deflate completely. Be sure to close the valves tightly to prevent leak on automatic inflation. Wear the vest over the clothing and **under the parachute harness.** Tuck the vest under the collar of your flight jacket.

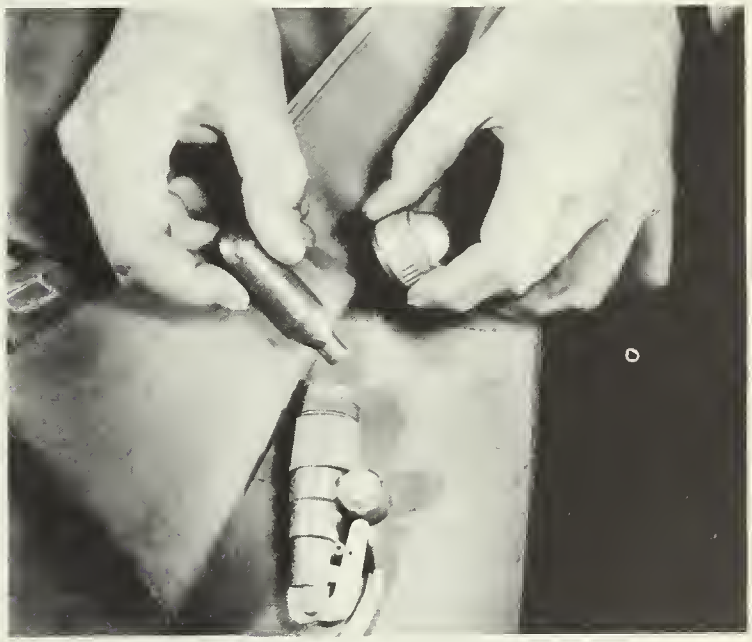
To inflate, pull one cord at a time so that if the mouth valves have been left open you will discover the error before you have discharged both CO_2 cartridges. One compartment will support you and will interfere less with swimming.

If the vest leaks, or fails to inflate completely from the CO_2 cartridge, fill by blowing into the mouth tubes. Open the valves while filling the vest by mouth, then reclose the valves tightly.

Note: cutting off or bending the mouth tubes flush with the retaining loop will prevent possible injury to your eye at the time your parachute opens.

Before each flight remove the cap from the inflator cylinder and inspect the CO_2 cartridge. If the seal at the tip is punctured replace the cartridge. With the lever which actuates the puncturing pin in the up position, parallel to the container, insert the new cartridge, seal end down. Always check the cap to be sure it is screwed down tightly.

REFERENCES: Technical Order 13-1-3 and Technical Order 13-1-17.



Inserting CO_2 inflator. Screw cap down tight.

Sea Marker Packet

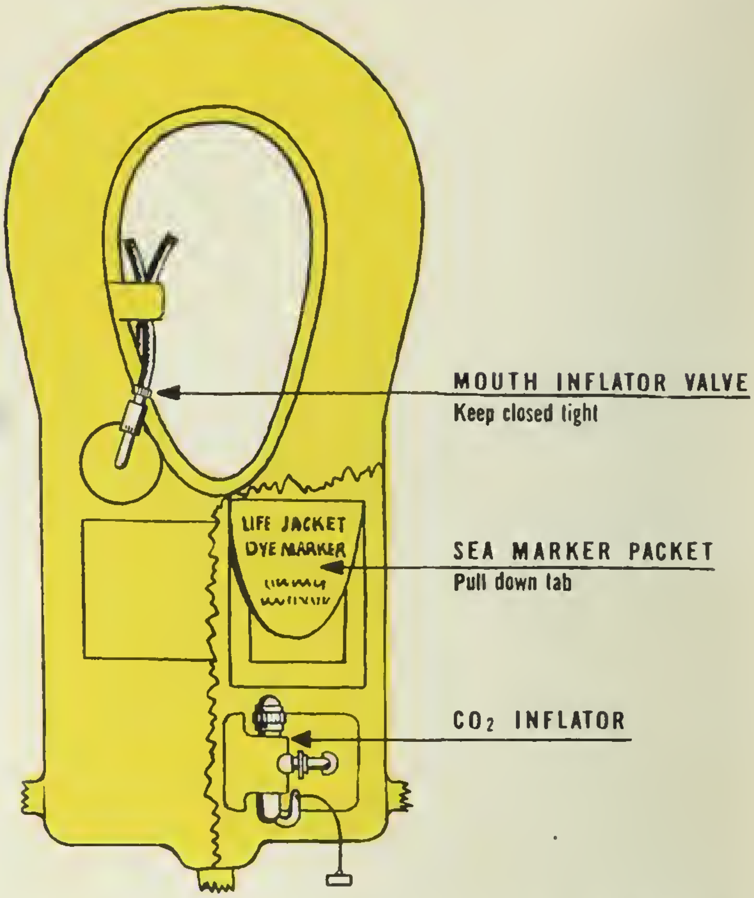
A sea marker packet is cemented to the life vest. When friendly airplanes approach, release the packet by pulling down on the tab. The dye will form a large green area lasting three to four hours. This will help airplanes to find you.

Caution

Before takeoff be sure your life vest cartridge containers are loaded with live CO_2 cartridges, **and that the container caps are screwed down tightly.** (See illustration.)

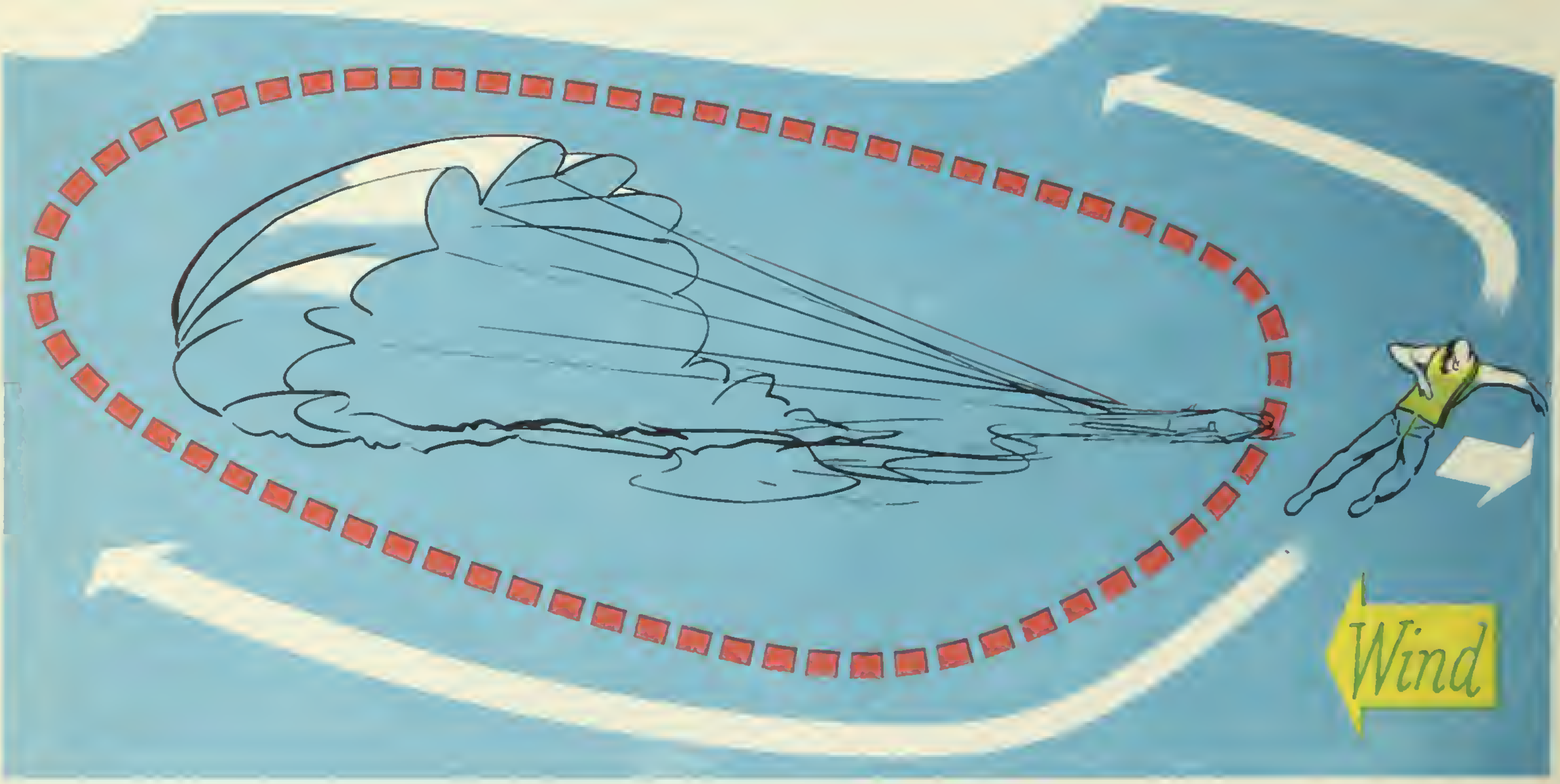
Always make certain that the mouth inflator valves are tightly closed before pulling the inflating cords.

Turn in your life vest for inspection every six months.



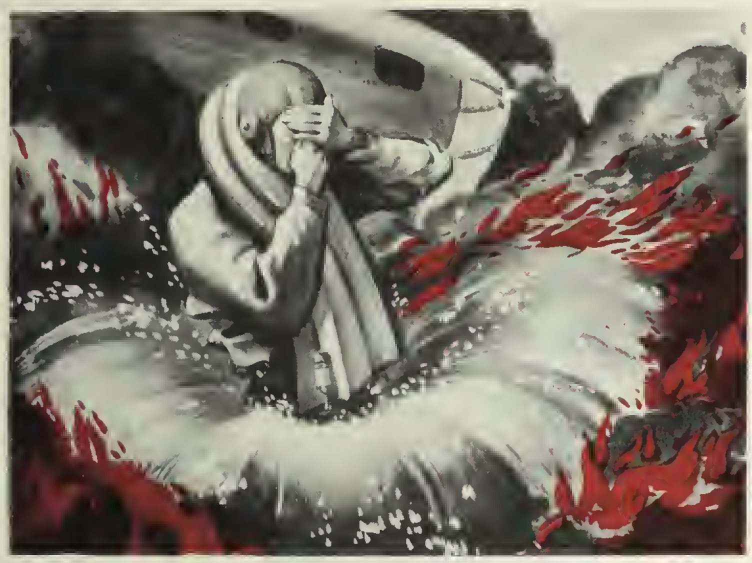
WARNING: STAY AWAY FROM YOUR CHUTE IN THE WATER

After parachuting into water you will have a tendency to drift downwind into the fallen parachute as soon as you inflate your life vest. To avoid entanglement with harness and shroud lines, work upwind, away from the chute, and stay clear. If you have a raft, salvage your parachute for sail, cover, and extra lines. If not, get away from the chute and stay away.

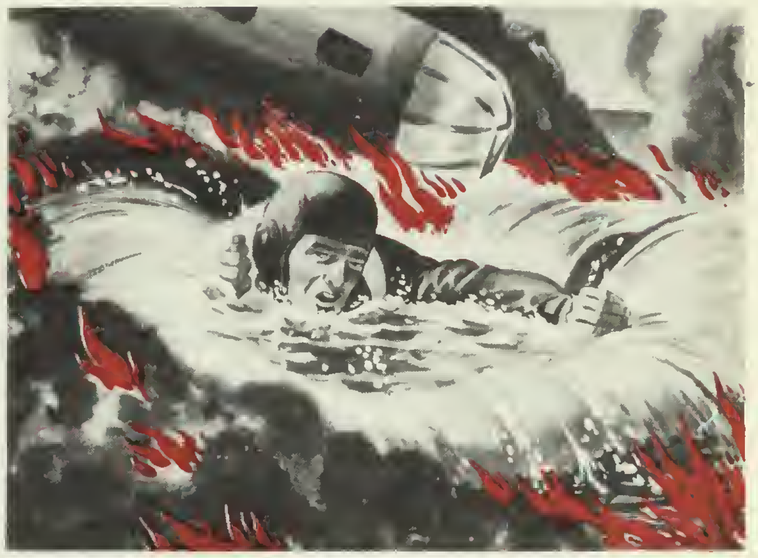


Swimming Through Fire

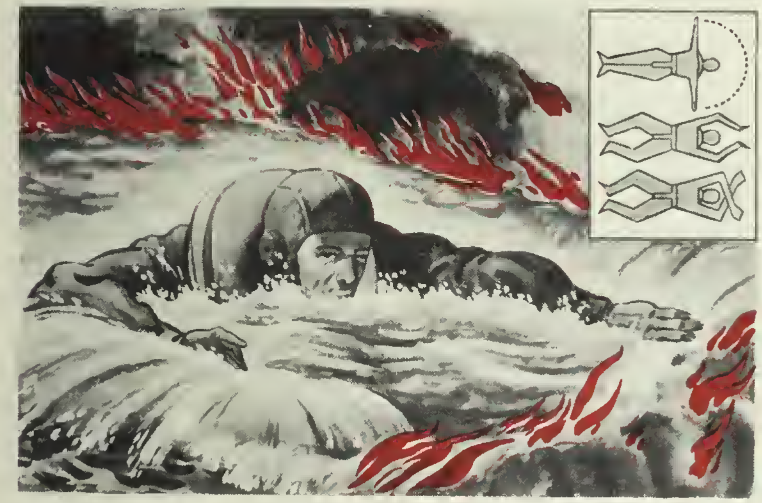
When an airplane is ditched at sea there is always the possibility that a smashed wing tank and engine will spread flaming oil and gasoline on the water. By using the following procedure, however, you can swim to safety through such a fire, even when you wear a life vest.



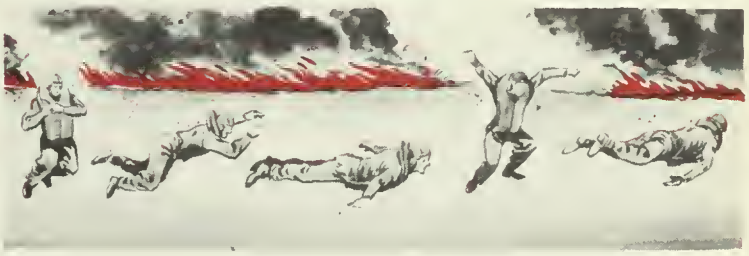
1. Jump feet first upwind of your airplane. Cover your eyes, nose and mouth with both hands. Take a deep breath. Hold breath until you rise to the surface.



2. Just before you reach the surface, make a breathing hole in the flames. Swing your arms overhead to splash flames away from head, face, and arms.



3. Swim into the wind. Use the breast stroke. Before taking each stroke splash water ahead and to the sides. Keep mouth and nose close to the water. Duck your head every third or fourth stroke to keep it cool. If there are several men, swim single file. Let the strongest swimmer splash a path so the rest can follow safely in his wake.



Swimming Under Water

If the heat is too intense or flames too high, swim underwater—out of the danger area. To do this:

1. Splash flames away from body.
2. Hold head near water level.
3. Deflate life vest by releasing valves.
4. Take a deep breath but do not inhale fumes.
5. Sink beneath the surface, feet first.
6. Swim upwind as far as possible.
7. Splash away the flames as you come to the surface. Take a deep breath and submerge again. Repeat procedure until you are beyond the fire.
8. Re-inflate life vest by mouth.

LIFE RAFT KITS AND DISCIPLINE

Equipment

Learn the use of life raft equipment now. Don't wait until you really need it. Ask your Personal Equipment Officer to demonstrate its use, and hold frequent drills.

The parachute is a valuable item of equipment in a life raft. If possible, take at least one out of your plane when abandoning it. The parachute will float for about 5 minutes when packed. Parts of the canopy can be used for bandages, sunshade, or as a sea anchor. The shroud lines can be used for fastening and in rigging the sunshade.

If there are two or more rafts, connect them with line provided, to keep them from becoming separated. Fasten the kit and all loose gear to the raft with tight but easily untied knots.

Get the emergency radio into operation as soon as weather permits. Instructions are on the set. Keep all signaling equipment where you can get at it quickly. Keep flares, Very Pistol, and cartridges as dry as possible. Use a flare only when a ship or plane is near. Fire the pistol almost vertically for maximum height and ahead of the plane so that the shot will be within the visibility range of the pilot.

Use the tarpaulin, yellow side up for a signal, blue side up for camouflage from the enemy.

Keep the sea anchor out. It will head you into the wind or check your drift.

Water and Food

Before any over-water flight, have all crew members and passengers drink all the water they can. Don't run the possible risk of starting your raft expedition thirsty. The pilot is in charge of water rationing. Uninjured survivors should drink no water the first day. Each person should then drink a pint a day until the supply is exhausted. But don't give up even then. With care and good luck you can still survive for several days, even without water.

To cut down on your water requirements:

Rest as much as possible.

Expose your body to the breeze as much as possible, but protect against sunburn.

Shade your body without cutting off the breeze.

Keep clothing wet with sea water during the day, but not to the point of chilling.

If it rains, collect rainwater in the tarpaulin or sail after first rinsing off the salt. Then drink your fill slowly over the course of an hour or more. Store the remainder in all available containers. Then return to the ration of a pint a day.

Never drink sea water, urine, or compass fluid.

Don't eat flesh of fish, turtles, or birds, except in small quantities, unless you have a good water supply. If it makes you thirsty don't eat it at all.

Protection

Protection from the sun is vital in the tropics. By keeping shaded you will prevent sunburn and cut down on your water loss through perspiration. Rig the oars and tarpaulin as a canopy and stay in the shade. Your face, neck, arms, and legs are most liable to sunburn. Protect them. Wrap exposed parts of the body with a piece of parachute, bandage, handkerchief, or a strip of underwear. Wet yourself, clothing and all, with sea water, but keep the water out of your mouth.

Continued exposure to sea water in the raft may result in a condition called **immersion foot.** When this occurs the legs and feet become swollen, sore, and numb, and blisters may form. You can help prevent immersion foot by keeping your feet as dry as possible and by moving them to encourage circulation. If they become swollen, don't rub them; this will only make them worse. Instead, cover them with the ointment in the First Aid kit and wrap them loosely with bandage or a strip of parachute.

Cover burns and skin irritations with the ointment and a light bandage. Don't prick or squeeze boils; bandage them instead.

You may go several days without a bowel movement. This is not harmful and is to be expected. Never take a salt water enema or a laxative. They increase your water loss.

Establish a watch routine if more than one man is aboard. Someone should always be on the alert.

Tie all injured persons to the raft, and as many others as your rope will allow.

LIFE RAFT KIT

Accessories for multiplace life rafts are carried in a kit and include the following items:

Signal kit (Pyrotechnic projector and 6 flares).

Emergency drinking water, 7 cans. Don't open before flight or water will spoil. Save cans for storing rain water.

Sea marker, 3 cans. When you see a plane, pour a can of marker on the water and stir it with an oar so it will spread. Do this quickly.

Life raft rations, 7 cans.

Flashlight, hand energized.

Knife, floating, cemented to raft.

Police whistle, to attract attention.

First Aid kit (Medical Supply Catalog, #9776900).

Fishing kit. Don't let hooks puncture raft.

Paulin for use as a sail.

Paulin for signal, shade, camouflage, and catching rain water.

Sun protective ointment, 4 tubes.

Emergency signaling mirror.

Wrist compass.

Religious booklets.

Water containers, 4.

Cellulose sponge.

Aluminum oars, 3.

Hand pump and hose.

Repair kit.

Bailing bucket. Use it also for urinating; don't stand in raft.

Repair plugs, 4.

Ocean charts.

Gatty's Raft Book.

Survival booklet.

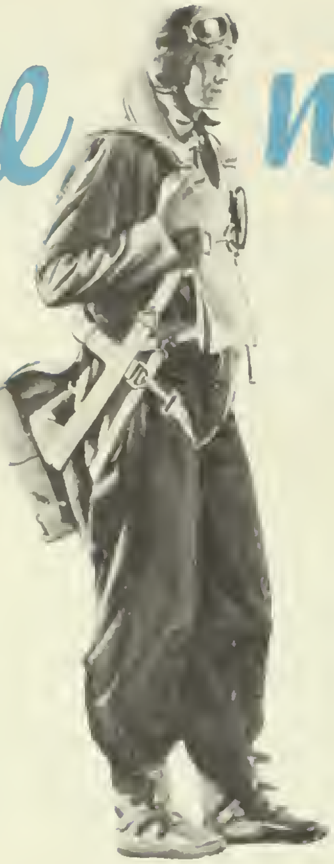
Twine, 40 feet. Tie loose equipment to life raft.

Sea anchor.

Warning

Be sure life raft is completely deflated before storing it away in the airplane. Use deflating pump. Air or carbon dioxide left in the life raft will expand at altitude.

One man LIFE RAFT



Raft lanyard goes under harness and clips to life vest ring.

Pre-Flight

The one-man life raft is stowed in a seat pack attached to the parachute harness. It is inflated after the jumper strikes the water.

When you put on parachute and life raft pack, **clip the lead strap from the raft to the ring of the life vest waist strap under the harness.** Otherwise you will lose the raft pack when you get out of the harness.

Before flight unsnap the pack cover far enough to expose the CO_2 cylinder. Test the locking pin.

In the Water

Pull open pack cover. Pull locking pin out of valve handle and open valve to inflate. Enter raft from small end by grasping hand straps and pulling.

Aboard the Raft

Keep your life vest on.

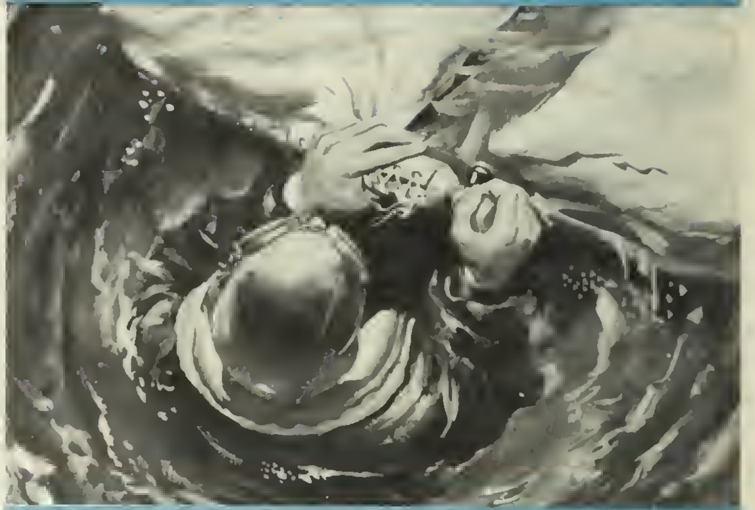
Top off inflation by blowing in the rubber mouth tube. Tighten valve after inflating.

Keep the CO_2 cylinder on the valve. The valve might leak if exposed.

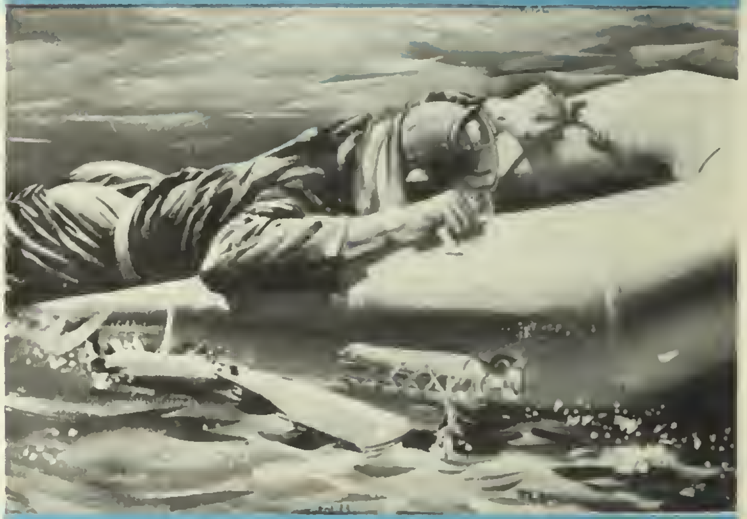
Keep the lead strap from raft clipped to yourself.

Fasten down everything aboard.

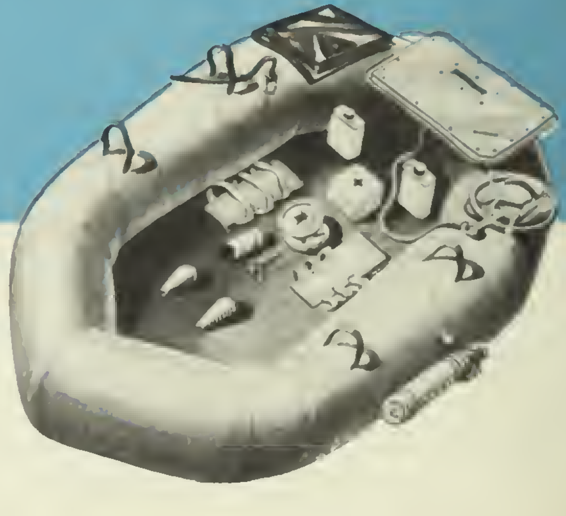
The raft contains sea marker, sea anchor, bailing bucket, bullet-hole plugs, blue and yellow cloth, first-aid kit, repair kit, paddles, and water. The water may be replaced by a chemical sea water purification kit in some rafts.



To inflate raft pull out locking pin and open valve slowly.



Board raft from small end by pulling it under you.



Fire Fighting

KNOW THE HAZARDS OF FIRE IN AIRCRAFT—BE FAMILIAR WITH THE PROCEDURE FOR FIGHTING FIRES ON THE GROUND AND IN FLIGHT

In Flight

Use all fire extinguishers applicable and follow proper procedure at once.

Prepare for emergency. Warn every man on the airplane to attach his parachute and to move to his proper position for bailout.

Determine whether a landing will be attempted or the airplane abandoned.

If airplane is to be abandoned, climb to a safe altitude, if possible, then give the order to bail out.

Engine Fires

At the first sign of a fire, if conditions permit, use the following procedure on the affected engine:

With built-in carbon dioxide system:

1. Cowling flaps "OPEN".
2. Shut fuel "OFF".
3. Feather propeller.
4. Turn ignition "OFF".
5. Set extinguisher selector valve.
6. Release carbon dioxide charge.
7. Do not start engine again.
8. Land as soon as possible, determine cause of fire, and correct condition before continuing flight.

Without carbon dioxide system:

1. Shut fuel "OFF".
2. Turn ignition "OFF".
3. Feather propeller.
4. Cowling flaps "CLOSED".
5. Land as soon as possible, determine cause of fire, and correct condition before continuing flight.

Fuel Tank and Amphibian Hull Fires

If fuel tanks or hulls are equipped with built-in carbon dioxide system:

1. Locate source of fire.
2. Set extinguisher selector valve.
3. Release carbon dioxide charge.
4. If fire is accessible, use hand equipment.
5. Land as soon as possible.

If not equipped with built-in carbon dioxide system:

1. Locate source of fire.
2. If fire is accessible, use hand extinguishers.
3. If fire is on side of hull attempt to control flame by sideslipping away from fire.
4. Land as soon as possible.

Cabin Fires

1. Close windows and ventilators.
2. Locate source of fire.
3. If electrical, cut power to affected part.
4. If fuel line is leaking, cut flow through line.
5. Use all extinguishers available. (Open windows and ventilators as soon as possible after flames are extinguished.)
6. Land as soon as possible and correct condition before continuing flight.

Wing Fires

1. Turn all switches controlling electrical wing installations "OFF".
2. Attempt to extinguish flame by sideslipping the airplane **away from the fire, when possible.**
3. Land as soon as possible and correct the condition before continuing flight.

Drop Tank Fires

Airstream usually will extinguish fires involving all types of externally mounted drop tanks, without damage to wing structure. Drop the tanks only if fire persists. If your plane has a bomb bay type tank, drop immediately.

Flare Fires

If flares in the racks ignite, release the flares at once. Pry them loose if they stick in the racks.

In case of fire, don't open emergency hatches or bomb bay doors in the air, except for bailout. External fires may be drawn into the cabin. Drafts will cause cabin fires to flare up.

Open emergency hatches just before landing if fire makes a crash landing necessary, to permit escape or rescue without delay.

On the Ground

See that a member of the ground or air crew stands by with adequate, portable fire extinguishing equipment while your engines are being started.

Starting an engine is a critical fire moment. Backfiring sometimes ignites excess priming fuel in the induction system. If a fire starts it may spread rapidly.

In case of fire while starting engines:

1. Allow engine to continue running. Fire often is sucked through the engine and extinguished.
2. Signal crew to use portable fire fighting equipment at once.
3. **Notify tower to rush crash equipment.**
4. If fire persists, shut off the ignition and fuel supply.
5. Use the built-in CO_2 system if you have one.

IN CASE OF FIRE ON THE GROUND, USE YOUR CO_2 SYSTEM. THAT'S WHAT IT'S FOR!

Fire Fighting Equipment in Airplanes

LEARN THE LOCATION AND PROPER USE OF FIRE EXTINGUISHING EQUIPMENT INSTALLED IN YOUR AIRPLANE.

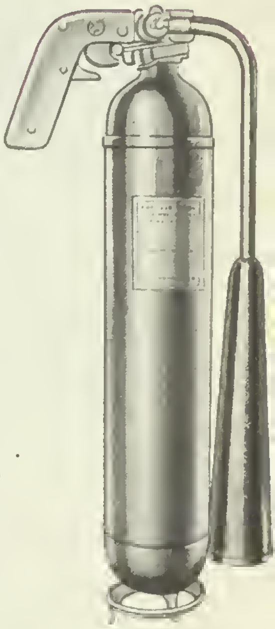
AIM AT BASE OF FIRE

"Fyr Fyter", hand-type fire extinguishers, having a carbon tetrachloride base, are found in most airplanes. Use this extinguisher primarily for fighting fires in the cockpit or cabin. It is unsuitable for extinguishing fires outside the fuselage during flight.

Aim at the base of the fire, remembering that your supply is limited and must be used effectively. The "Fyr Fyter" extinguisher in your plane has enough fluid to last for about one minute of continuous use. Its effective range is approximately 20 feet.

"CO_2", hand-type fire extinguishers, using carbon dioxide, also are found in large airplanes. Use this extinguisher for fighting fires inside the airplane.

The CO_2 extinguisher has an effective range of only 3 feet. The charge will last only 15 to 30 seconds, according to size of the unit. So aim at the base of the fire and move in close, on the upwind side. **Then pull the trigger release, directing the CO_2 straight at the base of the fire.** Move the discharge nozzle slowly across the flame area.



AIM BEFORE PULLING TRIGGER

Know the location of all extinguishers, their limitations, and how to use them.

Both of these extinguishers are effective in combating fuel, electrical, and wood or fabric fires. CO_2 is rapid, clean, and easy to use. However, because of the small quantity in the cartridge, it might not be final in action.

Built-in CO_2 (carbon dioxide) systems are installed in some types of airplanes, so that engines, hulls of amphibians, gasoline tank compartments, or even cargo sections may be flooded with carbon dioxide gas in case of fire. First, set the extinguisher selector valve to direct the CO_2 charge to the desired location. Then pull the release handle. The operating controls are marked clearly to indicate their method of use.

Precautions

Stand back, but within effective range, when using the "Fyr Fyter", carbon tetrachloride extinguisher. Open windows and ventilators after fire is extinguished. **The fumes generated are poisonous.** See a doctor as soon as you land if you have inhaled excessive amounts of the gas or have swallowed even a small quantity of the liquid.

Don't touch any portion of the discharge nozzle of the CO_2 extinguisher. The extremely cold temperature of the carbon dioxide may cause severe burns.

CREW FIRE DISCIPLINE

Be sure that your air and ground crews are instructed in fire fighting procedures and methods of fire prevention.

RELEASE DROP TANKS BEFORE A WHEELS-UP LANDING

FIRST AID KITS

CONTENTS

OUTSIDE PACKET

- Iodine swabs, (1 package)
- Bandages, gauze, adhesive, 1 pack.

LARGE COMPARTMENT

- Dressings, first-aid, large (2)
- Dressing, first-aid, small (1)
- Bandage, gauze, compress (1)
- Morphine Tartrate, ½ gr., 2 tubes
- Water Purification Tablets, halazone, 1 bottle
- Scissors, 1 pair
- Burn-Injury Set, boric acid ointment (1)
- Eye-Dressing Set (1)
- Sulfanilamide Crystals, 5 gram, 5 envelopes
- Sulfadiazine, 0.5 grm., 8 tablets
- Tourniquet (1)

The Kit, First-Aid, Aeronautic is a standard unit in all military aircraft (Medical Department Supply Catalog No. 9776500). It is designed for use of air crews and should not be opened by ground personnel unless there is urgent need. The contents of the main compartment are protected by a sealed zipper. Break the seal only when you need the contents of the inner kit for the treatment of injuries. A small packet on the outside of the kit contains iodine swabs and adhesive bandages for the treatment of minor injuries. When the seal has been broken, notify your Personal Equipment Officer or Medical Supply Officer, so that he can check the contents and replace missing items. Keep your kit intact. Make sure it is sealed. Your life may depend upon it.

KIT, FIRST-AID, FOR PNEUMATIC LIFE RAFT

Medical Supply Catalog No. 9776900

This is a part of the life raft kit (See PIF 8-11-2). It contains morphine syrettes, bandage compresses, sulfanilamide powder, sulfadiazine tablets, and burn ointment.

PACKET, FIRST-AID, PARACHUTE

Medical Supply Catalog No. 9778500

To be attached to the parachute harness or Mae West life vest for constant availability. Should be carried in gun turrets and other cramped spaces where the larger Kit, First Aid, Aeronautic is not accessible. Contains tourniquet, morphine, wound dressing, 8 sulfadiazine tablets, and 5 envelopes of sulfanilamide crystals. You can open the packet by tearing either end of the outer container at the notch.

Your airplane is a good first-aid station. You have the Kit, First-Aid, Aeronautic, and the Packet, First-Aid, Parachute. Oxygen is frequently available. Splints, or splint materials, are at hand. Hot drinks are often carried in thermos jugs. In certain bombers you will be provided with blood plasma. Familiarize yourself thoroughly with the first-aid supplies which you carry, and get clearly in mind just what you can do with them.

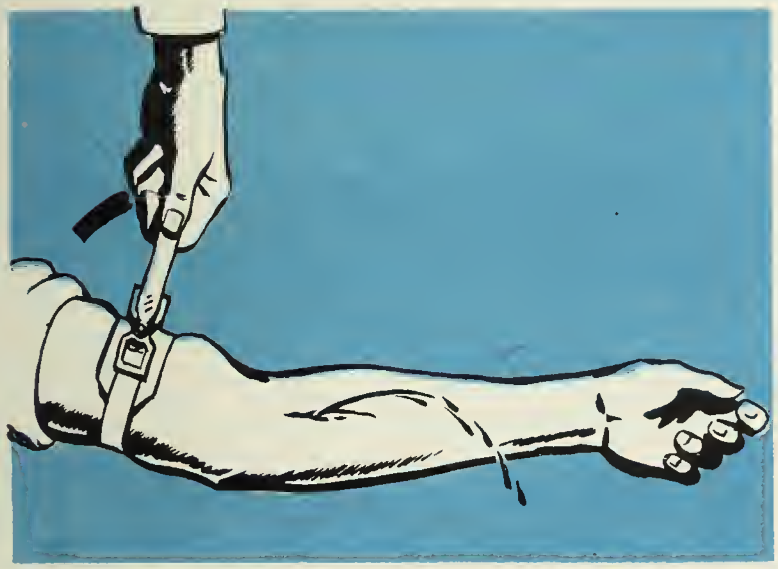
Wounds and Injuries

Wounds and injuries involve one or more of these problems: **pain, cuts, bleeding, broken bones, burns, frostbite, shock, and unconsciousness. Generally you** will have to deal with combinations of these, such as cuts which are bleeding, burns that cause pain, broken bones associated with cuts or burns, and so on. Shock usually comes on after a good deal of blood has been lost either inside the body (where you may not be able to see it), or on the outside. Shock also accompanies deep or extensive burns. Unconsciousness may be produced by a head injury, may follow shock, or may occur as a result of failure to get enough oxygen.

In giving first-aid, try to size up the general situation accurately. Then attend to the most serious problems first. Above all, use common sense.

Cuts and Bleeding

1. Expose wound by cutting nearby clothing with scissors.
2. Cover cuts with sterile dressings and apply firm pressure.
3. If this does not stop the bleeding, elevate the bleeding part.
4. If these measures fail to stop bleeding in arms or legs, apply a tourniquet in the middle of the upper arm or middle of the thigh. The tourniquet must be released every 15 minutes for at least a few seconds, depending upon the amount of bleeding.



Tourniquet (Warning)

A tourniquet must be removed, or temporarily released, every 15 minutes. **Failure to release the tourniquet often enough or long enough to provide an adequate circulation to the blocked portion of the arm or leg may necessitate amputation later.**

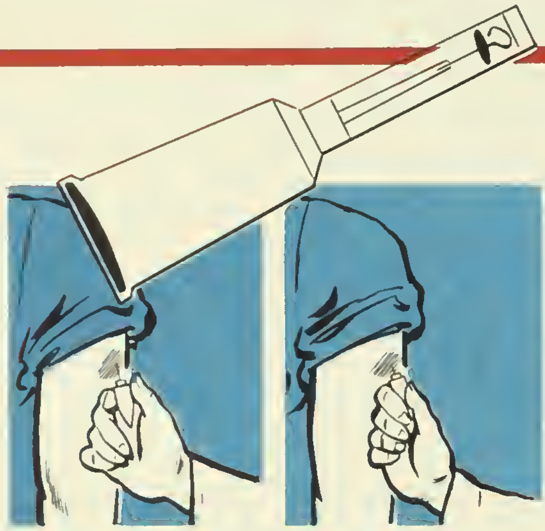
Pain

Use morphine at once for severe pain. This makes it possible for the patient to lie quietly, preventing aggravation of the injuries. Do not use more than one tube (½ grain) of morphine at any one time.

When giving morphine, mark down the time and dose on the patient's forehead or clothing with a pencil. Remember that an excess of morphine can be fatal. Do not give morphine to a person who is unconscious, who has a head injury, or who is breathing less than 12 times per minute.

To Give Morphine

1. Paint any small area of skin with iodine.
2. Remove the transparent cover from the morphine syrette.
3. **Push in the wire loop to puncture the inner seal;** then pull the wire out.
4. Thrust the needle through the skin, using care not to press morphine out of the tube while doing so.
5. Squeeze the tube slowly to inject the morphine.



Give Morphine:

1. To stop pain.
2. To decrease shock.
3. To facilitate moving the patient.

Don't Give Morphine:

1. To an unconscious person.
2. To a person with a head injury.
3. To a person who is breathing less than 12 times per minute.

Shock

You can tell when a patient is in shock by the total picture he presents rather than by any single sign. Usually he will have:

1. Lost considerable blood, or
2. Suffered severe burns, or
3. Been subjected to intense pain, or
4. Received a head injury.

His skin is pale, cold, clammy, or moist.

His breathing is shallow, and may be irregular.

His pulse is weak, rapid, thready, and often difficult to find.

Sometimes there is nausea and vomiting.

Treat shock by doing the following things as promptly as possible:

1. Stop any obvious bleeding.
2. Give pure oxygen to breathe. (Automix "OFF.")
3. Give morphine. (Exception: Head injury.)
4. Keep the patient warm with blankets, extra clothing, or a sleeping bag, but avoid excessive heat.
5. Loosen any tight clothing.
6. Place the patient with his head slightly lower

than his feet, to promote better circulation to the brain.

7. Inject plasma, when it is available, in accordance with the directions on the plasma package.

Fractures

1. If a broken bone is associated with a cut, sprinkle with sulfa powder and cover with a sterile dressing. If the dressing is firmly bound in place it will almost always stop the bleeding.
2. Give morphine.
3. Apply a temporary splint to the part, using wood, strips of metal, heavy cardboard, or any convenient pieces of equipment such as a machine-gun barrel or fire ax.
4. **Do not attempt to set the bone. Manipulation causes shock.**

Burns

For minor burns:

Squeeze burn ointment onto a sterile dressing. Then cover the burn gently with the dressing.

For severe burns:

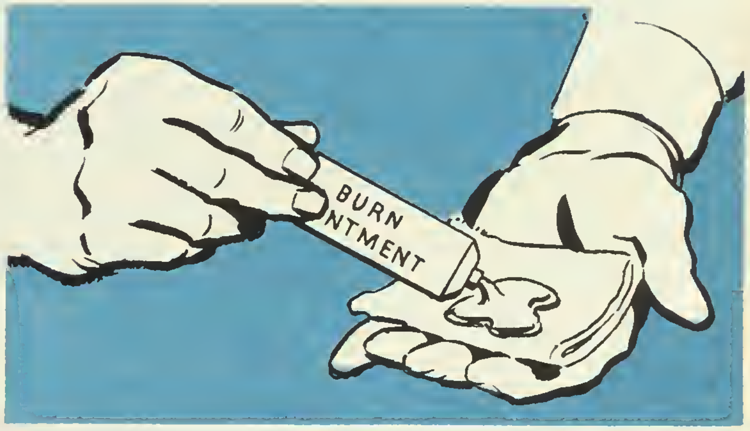
1. Give morphine.
2. Treat shock. (Oxygen; plasma, if available.)
3. Apply burn ointment on sterile dressings, **and bind the dressings gently but firmly in place.**
4. Never open blisters resulting from burns.

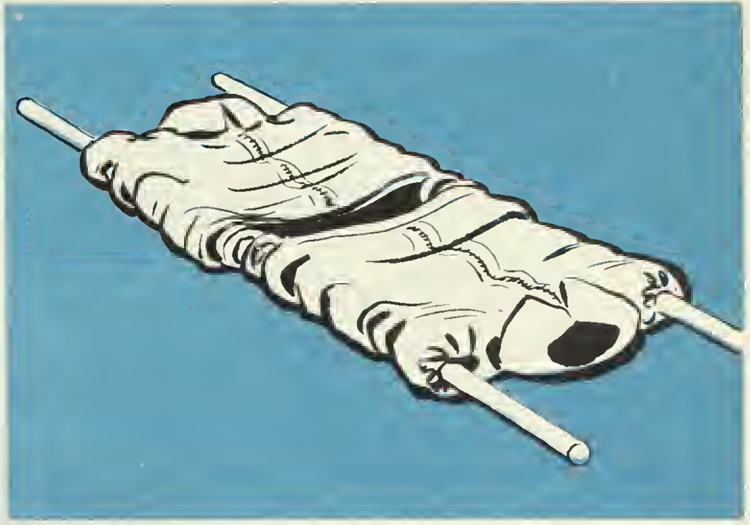
For eye burns

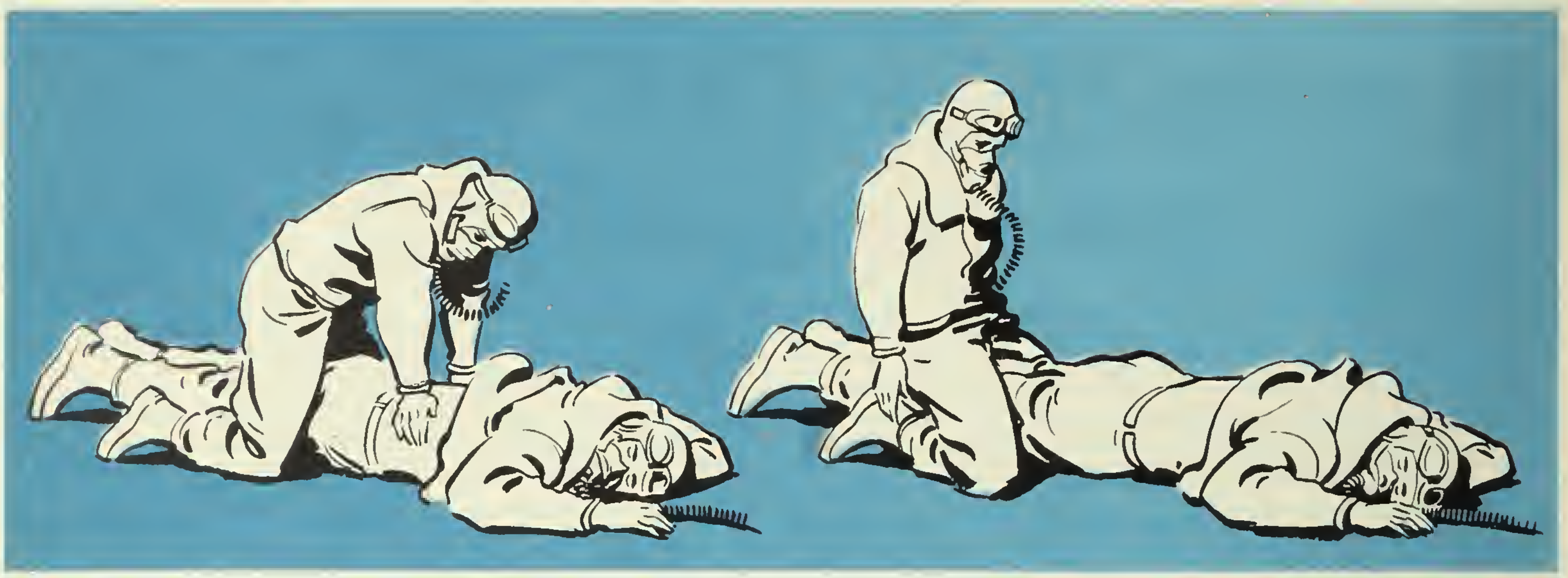
Apply Metaphen ophthalmic ointment directly to the eyeball. Then apply the boric acid ointment to the inner surface of the eyelid. Cover the eye with a dressing and secure in place with adhesive strips, provided the skin around the eye is not burned. Do not touch the eye with your fingers, and do not rub it—either before or after the ointment has been applied.

Transportation of Wounded

If it becomes necessary to move an injured crew member improvise a litter with 2 poles and a pair of flying jackets. Turn the sleeves inside out and insert the poles through them. Then close the jacket over the outside of the poles. Additional support can be obtained by using boards or cardboard splints inside the jackets. Litters can also be improvised with poles and blankets. Take great care to be as gentle as possible in moving an injured person onto a litter. Keep his body as flat as possible at all times. Have 3 or more persons move and support him by placing their arms under his legs, buttocks, back, shoulders, and head.







Unconsciousness and Near-Unconsciousness

Oxygen lack, carbon monoxide poisoning, and head injury are important causes. Immediate treatment is vital, especially if breathing has stopped.

1. Give artificial respiration:

First, lay the patient face down with one arm bent at the elbow, his face resting on his hand, and his other arm extended beyond his head.

Second, open his mouth and remove all foreign substances such as false teeth and chewing gum. If his tongue has fallen back into his mouth, grasp it with your fingers and pull it well forward.

Third, give him pure oxygen. (Automix "OFF.") **If the patient has stopped breathing, turn on the emergency flow.**

Fourth, kneel astride the patient's thighs with your knees about even with his. Place the palms of your hands against the small of the patient's back, with your little finger over the lowest rib.

Fifth, with your arms stiff, swing your body forward slowly so that your weight is applied over the patient's back. This should take about 3 seconds.

Sixth, release your hands with a sudden snap and swing backward to remove all pressure from the patient. After about 2 seconds repeat the cycle.

Continue giving artificial respiration without stopping for 2 hours or longer, unless the person to whom it is being given begins to breathe normally.

2. Keep the patient warm.
3. Do not give morphine.

Frostbite

1. Fingers, toes, ears, cheeks, chin, and nose are the parts most frequently affected.
2. Numbness, stiffness, and whitish discoloration are the first symptoms.
3. Wrinkle your face to find out if it is numb; watch for blanched faces of your crew mates.
4. If frostbite occurs, warm the affected part gradually. Never rub or attempt to thaw it rapidly.
5. If blisters develop, do not open them. (See HEAT AND COLD, PIF 4-7-3.)

Failure of Oxygen Supply

If a crew member's oxygen supply fails above 10,000 feet, make every effort to replace his equipment or give him an emergency supply. If this is not practicable, descend to 10,000 feet as fast as safe operation permits. Loss of oxygen above 20,000 feet is critical, but there is no need for panic. **Get oxygen, or get down.**

Wound Disinfectants

1. Sprinkle Sulfa powder in open wounds.
2. Use iodine only for small cuts and scratches, which should not be covered by a dressing.
3. Never put iodine on or into large or deep wounds.

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